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COMMERCIAL FERTILIZER

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ERNEST H. ABERNETHY, *President*

BRUCE MORAN, *Editor* V. T. CRENSHAW, *Business Manager*

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In This Issue

Chicago Representative
ELON A. ABERNETHY
1323 S. Michigan Ave.—Room 400
Phone Harrison 7-3655

West Coast Representative
M. A. CALDWELL
2267 W. 24th St., Los Angeles, Cal.
Phone REPUBLIC 1-3050

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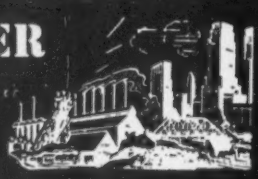

By Vernon Mount

KOREA TRUCE should have no effect on business, and none on the high wages of the biggest labor force in our history.

TRUCE IS NOT PEACE, nor does it cure the basic problems which face us, and call for a war status even when there is no actual war being fought. Call it a "cold" war if you will, but it still demands preparation.

THE RUSSIAN SWORD still hangs over us, and we must be watchful around an almost complete circle of USSR frontier. We seem to be making progress around that circle, however. France and Germany are not as irreconcilable as we thought. The Russian satelites are restless, unhappy - a real problem for their present masters. Russia and Red China are not seeing eye to eye.

WE ARE BUILDING WAR PLANTS, and we'll keep on building them. We'll continue to build and remodel and change our war preparations as we learn lessons such as the problem of the MIG plane. And that will keep us from having any surplus labor. High wages will keep buying power high.

A LULL IN INFLATION has been with us for a year now. Prices have really needed little or no controls. Unless the Government encourages another cycle of leaping wages, prices are likely to continue a sidewise move.

Yours faithfully,

Vernon Mount

A Sure Sign of Spring ... SUGAR-MAKING

If you live where the snow falls, where the temperatures in February and March rise above and fall below freezing, no doubt you've enjoyed the thrills of sugar-making.

When the sap is rising in the sugar maples, another growing season is beginning on the farms . . . another big season for commercial fertilizers is on the way.

If you are a producer, packer, or shipper of fertilizers, pack your products in RAYMOND MULTI-WALL PAPER SHIPPING SACKS . . . the Fertilizer Shipping Sacks that lead the parade in quality, dependability, and sales appeal.

These tough, strong Shipping Sacks are CUSTOM BUILT in various types, sizes, and strengths. They are available in multi-colors or plain.

A Raymond representative will be glad to assist you in selecting the perfect Raymond Shipping Sack for your special packing and shipping needs.

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...FROM LOCAL RAW MATERIALS!

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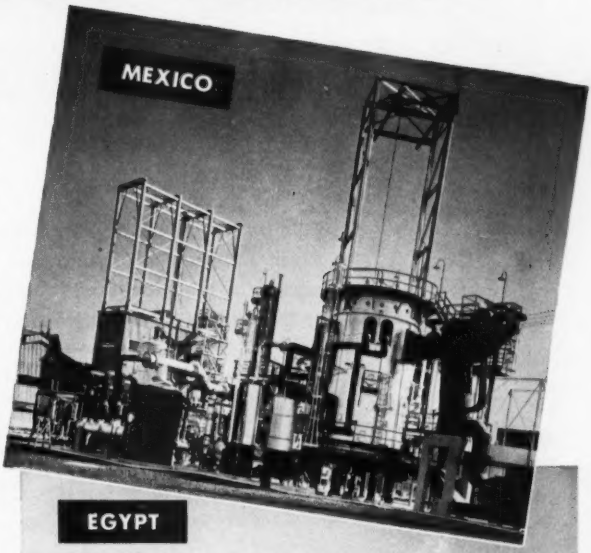
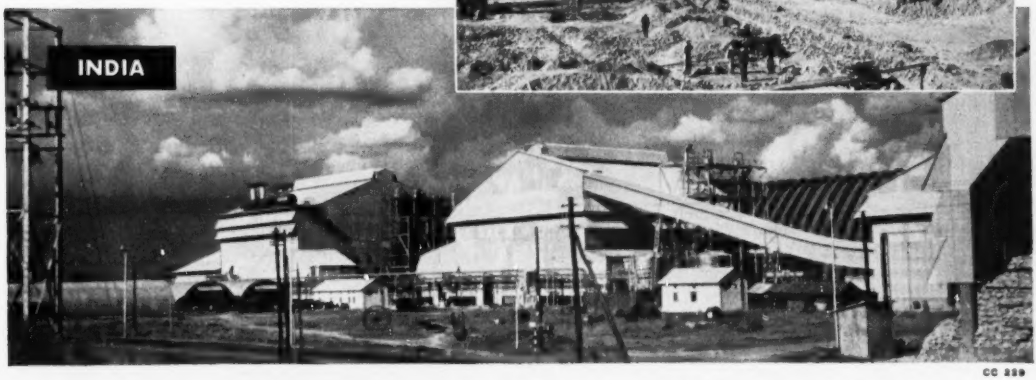
MEXICO—This fertilizer project manufactures 70,000 tons of ammonium sulfate per year. The ammonia is derived from *natural gas and steam* which provide the hydrogen, and from air which supplies the nitrogen. Sulfuric acid produced from byproduct sulfur is mixed with ammonia to produce ammonium sulfate.

EGYPT—This large Suez project will eventually produce 200,000 tons of calcium nitrate annually from limestone and nitric acid. The intermediate product, ammonia, is manufactured from the *waste gas of a nearby petroleum refinery.*

INDIA—This large plant at Sindri is designed to produce 350,000 tons of ammonium sulfate per year. Major raw materials are *coal, coke and gypsum*—all indigenous to India.

Chemico has a wide experience in the utilization of these and other raw materials for the production of ammonia and nitrogenous fertilizers. If you are thinking of producing ammonia or nitrogenous fertilizers, Chemico will be glad to consult with you and make specific recommendations.





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Bagpak has been manufacturing multiwall paper bags since 1928 — makes all kinds of multiwalls, in basis weights to meet any strength required, in a complete size range, without printing or with "non-smear" printing up to four colors.

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Five different I.P. Mills supply bag kraft — not only Natural but also Colored Kraft Paper, as well as Polyethylene Liners, Asphalt Laminated Kraft and Wet Strength Paper. Each bag mill is located on two or more different railroads. Two traffic departments assure prompt delivery.

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This is good news in agriculture and in industry. Increased availability of vital plant nutrients in the form of soluble inorganic salts for fertilizer solutions can mean new products and new markets for fertilizer manufacturers.

New emphasis is being placed upon WATER-SOLUBLE FERTILIZERS. Growers and manufacturers are developing new methods . . . new applications of high-analysis soluble plant foods which combine NITROGEN . . . PHOSPHORUS, POTASH and, in many cases, weed killers and insecticides, too.

MONSANTO, to help meet the increasing demands for plant foods, has increased quantities of four basic, soluble fertilizer chemicals . . . MONO AMMONIUM PHOSPHATE . . . DI AMMONIUM PHOSPHATE . . . MONO POTASSIUM PHOSPHATE . . . PHOSPHORIC ACID 75.0%.

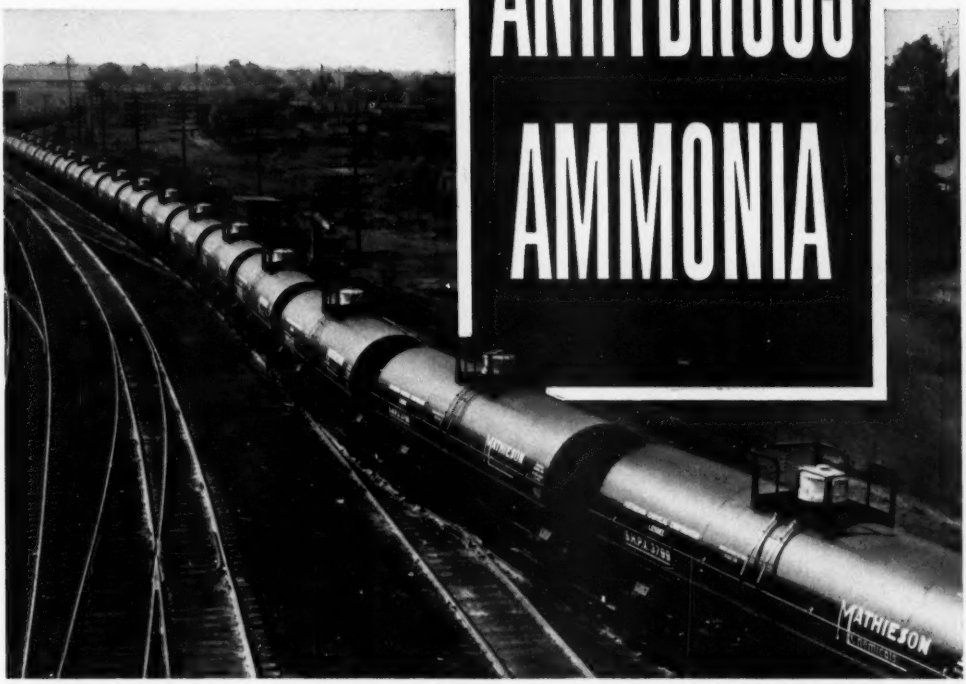
New uses for WATER-SOLUBLE FERTILIZERS are proving profitable for growers . . . profitable for FERTILIZER MANUFACTURERS. Perhaps these products will fit into your production planning. Contact any District Sales Office, or write MONSANTO CHEMICAL COMPANY, Phosphate Division, 1700-C South Second Street, St. Louis 4, Mo.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto Canada Limited, Montreal.

MONSANTO PLANT NUTRIENT CHEMICALS			
	N	P_2O_5	K_2O
Mono Potassium Phosphate (Crystals)	—0—	51.6%	34.2%
Di Ammonium Phosphate (Crystals)	21.0%	53.85%	—0—
Mono Ammonium Phosphate (Crystals)	12.2%	61.61%	—0—
Phosphoric Acid (75.0%) (Liquid)	—0—	54.5%	—0—

Mathieson

ANHYDROUS AMMONIA



Mathieson has rushed the reactivation of the Morgantown Ordnance Works in order to help relieve the over-all shortage of nitrogen.

Now...from one of the largest synthetic nitrogen plants in the world . . . Mathieson Anhydrous Ammonia will be available in increasing quantities for shipment in tank car lots.

For further information write Mathieson Chemical Corporation, Baltimore 3, Md.

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Ample resources for prompt deliveries of large tonnages from *International's* modern mines and plants in Florida at Noralyn, Peace Valley, Achan, Mulberry; in Tennessee at Mt. Pleasant and Wales.

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- **natural ground rock phosphate for direct application to the soil**
- **phosphate for the manufacture of industrial chemicals**

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Report for AGRONOMY*

By T. HAYDEN ROGERS
President, Southern Section
American Society of Agronomy

According to Webster the word "Agronomy" means "scientific crop production." No agronomist would claim that it is a completely accurate definition. "Scientific crop production" depends not only on agronomy and its various branches, plant and soil Scientists, but also on pathology, entomology, agricultural engineering, and many other related sciences. Economical crop production and utilization of crops cannot be accomplished without close cooperation between the various agricultural sciences. This meeting, the Association of Southern Agricultural Workers, is an excellent example of this type of cooperation. The Agronomy Section of the ASAW is composed of the Soils and Crops Divisions. These two divisions are holding a joint meeting and in addition are holding joint meetings with the Agricultural Engineering, Soil Conservation Service, Phytopathology, Animal Husbandry, and Dairy Science sections. Thus by working together, discussing common problems, exchanging information, progress has been made and will continue to be made.

Modern agricultural science has transformed American agriculture in the space of a lifetime. Agriculture in the United States has made more progress during the last 75 years than in the previous 75 centuries in many other parts of the world. This period of great achievement coincides with the development of research in the United States. Research information would be of little value if it were not for the disseminating agencies that carry the information to the farmer where it is applied in the production of more and better agricultural products. Results of research applied on the farm have meant a doubling of overall efficiency in the last 50 years. Fifty years ago one farm worker produced enough for himself and seven others. Today, he produces enough for himself and fourteen others, and we have more to eat and wear than we had 50 years ago. The Agronomist has contributed considerably to this achievement.

Cotton is, and has been for a long time, the leading cash crop in the South. Most of us remember the beginning of the cotton program. We also know that today we are producing essentially as much cotton on

(Continued on page 54)

*Presented at the Convention of Southern Agricultural Workers, February 5, 1952.

It Seems to Me

by BRUCE MORAN

Every once in a while the mail plays tricks, with a sequence of items from entirely unrelated sources, but that form a pattern. The other day it was like that. A bulletin from USDA on crop production goals—4% over last year; 50% over the 1935-39 average.

A release from Popular Mechanics Magazine reporting that the mechanization of agriculture and advancement of scientific farming make it possible for each farm worker of today to feed twice as many people as he could have in 1902. Eight then. Sixteen now.

And the data, much of which is in this issue, giving the USDA projection of the 1955 fertilizer picture.

Put those all together, and you see it may have been an accident that brought them all to my desk in one stack . . . but no accident at all that they were all issued at the same time.

The future is big and bright, as it has always been, for agriculture, and for those who serve the farmer well, it seems to me.

INDUSTRY CALENDAR

Date	Organization	Hotel	City
June 16-18	NFA	Greenbrier	White Sulphur
June 19-22	APFC	Homestead	Hot Springs
April 6-9	NACA	Fairmont	San Francisco
Nov. 10-12	CFA	Desert Inn	Palm Springs

Preliminary

FERTILIZER SITUATION REPORT 1951-52

OFFICE OF MATERIALS
AND FACILITIES
PRODUCTION AND MARKETING
ADMINISTRATION
U. S. DEPT. OF AGRICULTURE
January 11, 1952

According to the information now at hand, the 1951-52 supply of nitrogen and potash will exceed by a small margin the record quantities available for use in 1950-51. Somewhat less phosphate is in sight than was provided last season and orderly distribution will present problems.

Nitrogen: During 1950-51 there was available for use by farmers approximately 1,285,000 tons of nitrogen (N). The supply for 1951-52 is expected to be slightly higher, perhaps by seven percent, or about 1,375,000 tons, assuming net imports to be slightly above last year's levels. An increase in industrial demand or change in military requirements could upset this narrow improvement.

Table 2—Estimated phosphate supply for 1951-52 compared with 1950-51, United States and possessions.
(In short tons of 2,000 pounds P_2O_5 content)

Source and form	1951-52	1950-51 1/
U. S. Production		
Normal superphosphate	1,581,000 2/	1,712,000
Concentrated superphosphate	370,000 2/	357,000
Wet-base goods	14,000	12,000
Other 3/	160,000	157,000
Total	2,125,000	2,238,000
Inventory adjustment	—	40,000
Imports 4/	35,000	39,000
Total U.S. Supply	2,160,000	2,317,000
Exports	60,000	82,000
Net supply U.S. and possessions	2,100,000	2,235,000

1/ Data revised.
2/ Includes adjustment to reflect output of new superphosphate plants and expansion of existing ones.
3/ Includes estimates for complex phosphatic materials.
4/ Includes P_2O_5 content of prepared phosphatic mixtures, ammonium phosphates and superphosphates.

Table 3—1951-52 POTASH
1951/52 POTASH
Fertilizer Purposes—U. S. and Possessions
(Trade Delivery Basis)
In tons of 2,000 pounds potassium oxide (K_2O)

Source	Muriate of Potash 60% & 50% Grade	Sulfate of Potash & Sulfate of Magnesia Potash	Manure Salts	Miscellaneous & By-product materials 3/	TOTAL
Deliveries from U. S. Production 1/	1,230,000	102,000	3,000	35,000	1,370,000
Exports 2/	62,000	8,600		4,400	75,000
Net Supply—U. S. Production	1,168,000	93,400	3,000	30,600	1,295,000
Imports 2/	188,000	27,000		5,000	220,000
TOTAL SUPPLY					
U. S. and Possessions	1,356,000	120,400	3,000	35,600	1,515,000

1/ Based upon data supplied by the American Potash Institute.
2/ Calculated from Bureau of the Census reports.
3/ Partly estimated; includes potash content of oil seed meal and by-product residues used for fertilizer and calculated potash content of mixed fertilizers, exported and imported.

Table 4—Estimated Domestic Production, Supply and Disappearance of Sulfur (Equivalent Basis from Specified Sources) 1951-52 and 1954-55
(1,000 long tons of sulfur)

Material	1951-52	1954-55
Production:		
Crude mined sulfur	5,181	5,475
Recovered 1/	235	350
Pyrites	415	450
Zinc blende (including imports)	275	300
Sulfur—all other forms	50	335
Total U. S.	6,156	6,910
Exports:		
Crude to Countries except Canada	910	715
Crude to Canada	340	325
Refined	30	30
Total Exports	1,280	1,070
Total Available from U. S. Production	4,876	5,840
Imports	132	202
Total Available for Industrial and Agricultural Uses	5,008	6,042
Industrial	3,850	4,400
Balance for all Agricultural Uses	1,158	1,642
Sulfur Requirements:		
Superphosphate manufacturers	1,335	1,919
Sulfur equivalent of spent acid	- 110	- 150
Supplied from prime sources	1,225	1,769
Ammonium sulfate (adjusted)	287	343
Pesticides	275	350
Sulfur for Soil Amendment	21	25
Total required	1,808	2,487
Deficit for Agricultural Uses	650	845

1/ Includes recovered from pyrites, and not included in pyrites data.

1951/52 NITROGEN
Fertilizer Purposes—U. S. and Possessions
(Trade Delivery Basis)
In Tons of 2,000 Pounds Nitrogen (N)

Source	Ammonium Nitrate 3/	Ammonium Sulfate 4/	Other Solids 5/	Natural Organics 6/	Total Dry Nitrogen	N Solutions Compound 7/	NH_3 for Ammoniation 7/	NH_3 for Direct Application	Total Wet Nitrogen	GRAND TOTAL
U. S. Production										
Synthetic ammonia 1/	197,200	144,000	95,000	—	436,200	337,400	47,000	137,700	522,100	958,300
By-product ammonia 2/	—	180,000	—	—	180,000	—	2,000	300	2,300	182,300
Natural organics	—	—	—	40,500	40,500	—	—	—	—	40,500
Total	197,200	324,000	95,000	40,500	656,700	337,400	49,000	138,000	524,400	1,180,100
EXPORTS 1/	350	64,000	36,650	500	101,500	16,300	1,000	—	17,300	118,800
NET DOMESTIC DELIVERIES	196,850	260,000	58,350	40,000	555,200	321,100	48,000	138,000	507,100	1,062,300
IMPORTS 1/	97,050	44,000	170,650	1,000	312,700	—	—	—	—	312,700
TOTAL SUPPLY U. S. and Possessions	293,900	304,000	229,000	41,000	867,900	321,100	48,000	138,000	507,100	1,375,000

1/ Based upon special reports from industry components and Bureau of the Census data.

2/ Based upon reports of the Bureau of Mines and information from industry components.

Principally to prevent disclosure of individual company operations the following groupings have been made:

3/ Includes ammonium nitrate f.g., ammonium nitrate-limestone mixtures and ammonium sulfate-nitrate.

4/ Includes estimated ammonium sulfate content of imported and exported mixed fertilizers.

5/ Includes ammonium phosphates, sodium nitrate, urea mixtures, calcium nitrate, cyanamid and nitraphosphates.

6/ Estimated nitrogen content of natural organics used in commercial fertilizers.

7/ Includes estimated nitrogen content derived from solutions and ammonia in exported ammoniated superphosphates and mixed fertilizers.

Table 7—Estimated Consumption of Nitrogen (N), Phosphoric Acid (P_2O_5), and Potash (K_2O) for Fertilizer Purposes in the 1949-50 Fiscal Year Based on Reports Prepared by the State PMA Committees, by States and Regions.

State and Region	Total Tons N	Total Tons P_2O_5	Total Tons K_2O
Me.	14,000	22,300	24,200
N. H.	1,000	3,200	1,800
Vt.	1,100	10,100	4,600
Mass.	4,400	8,900	6,400
R. I.	1,000	2,100	1,800
Conn.	4,900	7,800	6,300
N. Y.	24,000	76,000	34,300
N. J.	11,900	27,000	24,600
Pa.	24,100	82,100	47,100
No. Atlantic	86,400	239,500	151,100
Ohio	25,600	123,100	96,400
Ind.	26,400	104,000	78,700
Ill.	17,800	74,200	53,000
Mich.	13,700	67,700	45,400
Wis.	13,100	48,500	50,100
Minn.	5,500	41,700	19,900
Iowa	15,700	51,100	14,200
Mo.	20,300	72,500	25,200
No. Dak.	1,000	13,800	600
So. Dak.	300	1,100	100
Nebr.	9,300	5,500	100
Kans.	19,400	41,900	4,100
No. Central	168,100	645,100	387,800
Del.	2,000	6,400	4,600
Md.	21,600	47,600	35,700
Va.	26,900	80,900	43,700
W. Va.	2,400	14,400	4,000
No. Car.	92,200	146,300	104,100
So. Car.	51,800	72,500	48,800
Ga.	62,200	106,400	68,600
Fla.	46,600	64,300	65,000
So. Atl.	305,600	538,800	374,500
Ky.	16,700	73,700	22,100
Tenn.	23,500	57,100	28,900
Ala.	58,300	92,000	50,300
Miss.	85,000	46,400	23,800
Ark.	32,200	23,500	19,000
La.	26,900	22,000	11,600
Okla.	4,800	29,300	2,900
Texas	28,800	78,700	11,500
So. Central	276,100	422,700	170,100
Mont.	1,900	4,400	(45)
Idaho	4,500	15,000	500
Wyo.	200	1,300	(28)
Colo.	2,600	7,800	1,200
N. Mex.	2,200	4,100	(40)
Ariz.	17,400	8,600	1,900
Utah	1,400	3,400	200
Nev.	200	700	(11)
Wash.	8,100	9,700	3,700
Oreg.	15,800	10,600	2,600
Calif.	97,300	49,200	12,900
West.	151,600	114,800	23,000
U. S.	987,900	1,960,900	1,106,500
Alaska			
Hawaii	20,500	8,400	13,500
P. R.	28,900	12,900	21,300
V. I.			
Insular	49,400	21,300	34,800
Total	1,037,200	1,982,200	1,141,300

Table 5—Plant food consumption in continental United States, Hawaii, and Puerto Rico, 1900 through 1949-50, with estimated supply for 1950-51 and preliminary estimates for 1951-52.

Tons Consumption 1/

Period	Nitrogen (N)	Available Phosphoric Acid P_2O_5	Potash (K_2O)	Total	(Percent)
1900	62,000	246,000	87,000	395,000	
1910	146,000	499,000	211,000	856,000	
1920	228,000	660,000	257,000	1,145,000	
1929-30	377,000	793,000	354,000	1,524,000	
1930-31	301,000	611,000	275,000	1,187,000	
1931-32	214,000	413,000	192,000	819,000	
1932-33	240,000	464,000	222,000	926,000	
1933-34	275,000	530,000	263,000	1,068,000	
1934-35	312,000	597,000	307,000	1,216,000	
1935-36	350,000	673,000	350,000	1,373,000	
1936-37	411,000	794,000	416,000	1,621,000	
1937-38	384,000	744,000	393,000	1,521,000	
1938-39	398,000	789,000	409,000	1,596,000	
1935-39 Av.	371,000	719,000	375,000	1,465,000	100.00
1939-40	419,000	912,000	435,000	1,766,000	120.55
1940-41	458,000	994,000	467,000	1,919,000	131.00
1941-42	409,000	1,131,000	547,000	2,087,000	142.46
1942-43	509,000	1,237,000	643,000	2,389,000	163.18
1943-44	640,000	1,408,000	649,000	2,697,000	184.09
1944-45	630,000	1,354,000	729,000	2,713,000	185.19
1945-46	701,000	1,553,000	807,000	3,061,000	208.94
1946-47	784,000	1,736,000	858,000	3,378,000	230.58
1947-48	857,000	1,854,000	921,000	3,632,000	247.89
1948-49	920,000	1,942,000	1,073,000	3,935,000	268.60
1949-50	1,005,000	1,951,000	1,105,000	4,061,000	277.20
		Supply			
1950-51 2/	1,285,000	2,235,000	1,445,000	4,965,000	338.90
1951-52 3/	1,375,000	2,100,000	1,515,000	4,990,000	340.6

1/ Plant food contained in commercial fertilizers, adapted from data compiled by BPISAE.
2/ Estimated supply available to farmers in 1950-51.
3/ Preliminary estimate (Jnuary 11, 1952).

Table 6—Estimated Utilization of Nitrogen (N), Phosphoric Acid (P_2O_5), and Potash (K_2O) by Principal Crops and Groups of Crops in 1949-50 Fiscal Year Based on Reports Prepared by State PMA Committees Dec. 1950.

Crop	Total Tons N	Percent of Total N	Total Tons P_2O_5	Percent of Total P_2O_5	Total Tons K_2O	Percent of Total K_2O
Corn	289,100	27.9	447,100	22.6	295,000	25.8
Cotton	144,100	13.9	141,900	7.2	90,400	7.9
Soybeans	2,300	.2	26,700	1.3	22,100	1.9
Peanuts	4,600	.4	20,400	1.0	12,800	1.1
Flax	1,400	.1	4,200	.2	1,700	.1
Wheat	61,000	5.9	219,400	11.1	98,900	8.7
Oats	54,000	5.2	161,900	8.1	85,400	7.5
Barley	8,100	.8	21,200	1.1	9,900	.9
Rye	3,000	.3	13,500	.7	5,700	.5
Rice	8,900	.9	4,900	.2	2,900	.3
Beans & Peas	2,000	.2	7,900	.4	3,100	.3
Cane (Sugar)	43,500	4.2	17,300	.9	32,700	2.9
Beets (Sugar)	5,300	.5	14,000	.7	4,400	.4
Potatoes	38,000	3.7	69,600	3.5	65,800	5.7
Vegetables						
Fresh	57,100	5.5	93,600	4.7	71,800	6.3
Processed	20,100	1.9	41,100	2.1	30,900	2.7
Tobacco	33,500	3.2	77,800	3.9	58,200	5.1
Hay	17,400	1.7	149,000	7.5	49,700	4.4
Pasture	26,100	2.5	208,500	10.6	68,200	6.0
Fruits						
Tree	55,000	5.3	51,300	2.6	51,300	4.5
Bush	8,400	.8	4,500	.2	3,500	.3
Nuts	4,400	.4	3,600	.2	2,700	.2
Sorghum	4,900	.5	4,400	.2	2,400	.2
Cover Crops	4,000	.4	51,600	2.6	12,900	1.1
Miscellaneous	112,700	10.9	67,100	3.4	19,700	1.7
Veg. Gardens	17,800	1.7	37,200	1.9	24,700	2.2
Non-Farm Use	10,500	1.0	22,500	1.1	14,500	1.3
Total	1,037,200	100.0	1,982,200	100.0	1,141,300	100.0

Phosphates: The 1950-51 supply turned out better than originally estimated, aggregating about 2,235,000 tons available phosphoric oxide (P_2O_5) basis. Some curtailment is expected in the production of superphosphate due to the sulfur and sulfuric acid scarcity. Allowing for such cutbacks and assuming normal export/import relationships the 1951-52 supply is tentatively estimated to be 2,100,000 tons P_2O_5 basis, or about six percent less than the available quantity in 1950-51.

Potash: A record 1,445,000 tons of potash (K_2O) were available for use in 1950-51. Although a substantial expansion program is underway in the Carlsbad area the contribution of these new facilities will not greatly affect the total tonnage available for use in 1951-52. The probable volume of imports is likewise not too certain at this time. For the present a conservative forecast of an increase of about five percent in the potash supply seems warranted, or some 1,515,00 tons K_2O for 1951-52.

Sulfur: During the year 1950-51 supplies of sulfur for agricultural uses such as superphosphates, ammonium sulfate, pesticides and soil amendments were insufficient to meet essential needs. A continuing shortage is anticipated for 1951-52 and ensuing years unless efforts are made to increase supplies and to promote the use of alternate materials or methods.

The total sulfur available from U. S. production in all forms in 1951 is estimated to be approximately 6,125,000 long tons as compared to 6,000,000 long tons in 1950. Production of crude sulfur (brimstone) in 1951 is estimated at approximately 5,225,000 long tons. The total exports of crude and refined sulfur in 1951 (including Canada) were set by quotas at 1,335,000 long tons. Upon completion of the exports for 1951 it is estimated that approximately 3,890,000 long tons of crude sulfur were available for domestic industry.

In estimating future requirements of sulfur for agricultural purposes the quantity needed for sulfuric

(Continued on page 44)

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The Land Needs More NITROGEN

By Dr. John R. Taylor, Jr.,
American Plant Food Council, Inc.,

Nitrogen is a key factor in crop production and the importance of this plant food to the national welfare is attracting more attention than ever before in history.

Many soils have lost as much as 50 percent of their original nitrogen and the time is past when appreciable areas of new land with high nitrogen content can be put into cultivation.

Combined with this decrease in soil nitrogen is the largest demand in history for food, feed and fiber production. Our population is increasing at a rapid rate—about 2½ million per year—and food consumption per individual is at a record high. Use of adequate nitrogen in combination with other essential plant foods and sound land management practices will make it possible to maintain soil productivity, increase crop production and make starvation or famine a remote possibility.

A decrease in soil nitrogen means also a loss in organic matter. The loss of organic matter means deterioration in soil structure or tilth which is so essential to soil productivity and the production of high crop yields. Many soils, particularly those in the south and far west, were low in nitrogen and organic matter when put into cultivation. However, the heavier soils of the midwest were relatively high in organic matter when broken for crops. On these soils, the loss of nitrogen and organic matter is very serious and the accompanying deterioration of soil tilth and low crop yields have received increased attention in the past decade. Many soils have developed hard pans at various levels which restricts root growth, aeration and other factors, thereby resulting in poor crop yields on once high-producing soils. For example, many reports show that even with ample fertilization, use of the best hybrid seed and cultural practices, corn yields remain around 40 to 50 bushels, whereas on soils just across the fence with good soil tilth, the yields have been doubled and are in the 100 to 125 bushels per acre range. This shows the importance of maintaining soil tilth.

The problem of maintaining good soil tilth is of importance throughout the country, but has particular significance in the midwestern states. Sod crops have been plowed up and put into clean cultivated crops, particularly corn and soybeans. At the same time, hybrid corn and better cultural practices have been introduced so that corn yields have increased, thus putting a heavier drain on the soil for nitrogen. The use of nitrogen fertilizers has increased, but only a

TABLE 1
NITROGEN CONTENT OF VIRGIN AND CROPPED SOILS

State	Nitrogen Contained in an Acre of Surface Soil		
	Virgin Lbs.	Cropped Lbs.	Percent Loss %
New York	—	—	25 to 50
Ohio	4214	2744	34.8
Illinois	—	—	30 to 50
Missouri	4276	2781	34.9
Iowa	—	—	31
North Dakota	3120	2153	31
South Dakota	6500	5080	21.8
Nebraska	4560	3466	24
Kansas	3695	2538	31.3
Oklahoma	3160	1460	53.8
Texas	1200	680	43

TABLE 2
NITROGEN REMOVED FROM THE SOIL IN 100 PRINCIPAL CROPS IN 1947

Region	Acres in Harvested Crops	Average Pounds Removed Per Acre
New England	3,600,000	29
Middle Atlantic	16,400,000	22
South Atlantic	24,000,000	15
East North Central	59,800,000	21
West North Central	133,700,000	20
East South Central	22,900,000	15
West South Central	52,800,000	16
Mountain	24,600,000	22
Pacific	15,100,000	27
United States	352,900,000	20

TABLE 3
AVERAGE AMOUNT OF NITROGEN SUPPLIED PER ACRE OF HARVESTED CROPS IN 1947

Region	From Fertilizers	From Manure
New England	13	29
Middle Atlantic	7	24
South Atlantic	20	1.6
East North Central	2.0	17
West North Central	0.3	5
East South Central	11	1.9
West South Central	2.4	0.4
Mountain	1.0	10
Pacific	15	6
United States	4	7.4

Presented at the annual Meeting of the American Association for the Advancement of Science, Section O (Agriculture), Philadelphia, Pa.

TABLE 5
APPROXIMATE DRY WEIGHT OF ROOT RESIDUES OF COMMON FIELD CROPS

Crop	Root Residues Lbs. Per Acre
Potatoes	321
Soybeans	550
Wheat	767
Corn	1160
Alfalfa (1 Year)	3040
Alfalfa (old sod)	3900
Brome Grass	3926
Blue Grass	4900
Timothy	5600

start has been made in this direction. I just wonder if on the average farm in this area, the losses of soil nitrogen and organic matter have not been greater during the past 10-year period than any similar period except when the soils were first put into cultivation?

Crop Yields

In recent years, the per acre yields of most crops have been increasing, thus tending to refute the evidence that soil nitrogen and soil productivity have been declining. These are good signs, but sober thought should be given before drawing hasty conclusions. The per acre yields of corn, cotton, wheat, and hay have gradually increased since 1935, but for over half a century prior to that time, average yields remained about the same. During this time, many changes were made which should have increased yields. But, these improvements only barely managed to offset the decrease in soil productivity which was taking place. Vast areas of fertile Virgin soil were plowed up and put into cultivation, while worn-out land was discarded. Acid soils were limed and commercial fertilizers were used in increasing amounts. Millions of acres of wet soils were drained and farm machinery was improved. Legumes were grown in rotation and crop varieties were improved. Crop diseases and insects were better controlled. Still, crop yield remained about the same.

Since 1935, crop yields have been increasing and farmers are making better use of research and extension programs. Soil erosion and water conservation practices are being put to work on the farm. The use of nitrogen fertilizers has grown by leaps and bounds. In 1935, only 312,000 tons of commercial nitrogen were used in the United States, compared to 1,285,000 tons in 1950-51. Crop yields have been increasing, but present average yields can be doubled.

Table 4—Crop Rotations, Fry Farm, Ohio Exp. Station, 1937-1949 Inclusive.

Rotation	13 yr. ave. yield in Bu. or T. per acre			Soil nitrogen lbs. Gain (+) or loss (—) For Period
	Corn	Wheat	Hay	
Continuous Culture				
Corn, no cover crop	33.0			—445
Corn + sweet clover crop	37.4			—350
Two Year Rotations				
Corn, wheat	46.8	24.4		—214
Corn, wheat-sweet clover + 4 T.M.	66.2	35.1		—224
Three Year Rotations				
Corn, wheat, clover	66.6	38.5	2.53	?
Corn, wheat, clover + 6 T.M.	72.8	42.4	2.69	+ 34
Four Year Rotations				
Corn, wheat, alfalfa, alf.	68.0	41.8	2.66 & 3.36	— 25
Corn, wheat, alfalfa, alf. + 8 T.M.	70.5	42.8	3.10 & 4.37	+173
Five Year Rotations				
Corn, wheat, alf. 3 years	71.5	43.8	2.44 & 3.31 & 3.73	+101
Corn, wheat, alf. 3 years + Residues	72.0	42.9	3.24 & 3.94 & 4.54	+121
Corn, wheat, alf. 3 years + 10 T.M.	71.0	41.4	3.50 & 4.45 & 4.62	+303

Basic Treatment: Land limed as needed, all rotations fertilized at average rate of 150 lbs. 0-14-7 per acre per year divided among corn, small grain and 3rd year meadow. Manure (M) applied on corn or divided between corn and top dressing on wheat when seeded to legume.

Table 6—Soil Humus Formed in the Soil From Decomposition of 7,000 Pounds of Different Crop Residues

Residue	Carbon-Nitrogen Ratio	Residual Humus—Lbs.
Corn Stover	48.1	1185
Straw	41.1	1747
Red Clover	26.1	3166
Sweet Clover	12.1	3496
Any of above plus Nitrogen to give	10.1	3725 (approx.)

Data: Ohio Experiment Station Agronomy Mimeograph No. 93, 1944.

Table 7—Consumption of Nitrogen by Regions Year Ending June 30, 1950

Region	Tons Nitrogen In Mixed Fertilizers	Total Tons Nitrogen In All Fertilizers
New England	20,611	23,838
Middle Atlantic	61,732	69,065
South Atlantic	161,429	275,392
East North Central	71,244	94,509
West North Central	25,430	59,802
East South Central	72,672	192,877
West South Central	28,994	94,680
Mountain	4,840	22,125
Pacific	20,057	123,351
Territories	28,351	49,813
Total U. S.	495,360	1,005,452

Soil Nitrogen Losses

Soil nitrogen losses are due primarily to cultivation, removal by harvested crops, erosion and leaching. Cultivation is by far the most destructive.

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MORE CORN. Field at left yielded 95.7 bushels after getting 200-250 lbs. of nitrogen fertilizer, plowed down, and 120 lbs. of 4-24-12 in the row. Field on right received 200 lbs. of 0-18-0, plus 145 lbs. of 8-8-8 in the planter; yielded but 44.5 bushels.

MORE WHEAT. Near Cheney, Kansas, Keith Foley came out 200 lbs. short on nitrogen fertilizer. Note the result: Wheat that received no nitrogen (right) produced 9.7 bushels. The portion that got nitrogen (left) yielded 20.0 bushels.

MORE PASTURE. By topdressing ammonium nitrate fertilizer in the fall and spring, J. B. Spears and Sons of Covington, Ga., grazed 225 head of mature beef cattle from October thru March on 140 acres of fescue and Ladino clover!

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In general, soils seek an equilibrium point relative to content of nitrogen and organic matter, the level of which depends primarily upon climate, vegetation, and physical characteristics of the soil. Therefore, the nitrogen content of soils is quite variable in the United States.

In the Southeastern states and parts of the far west, the nitrogen content of virgin soils is generally very low, having less than 1,000 pounds of nitrogen per surface acre. Nitrogen is highest in the northern plains and prairie states, with total nitrogen around 4,000 to 6,000 pounds per surface acre, while in most of the United States, the soils contain less than 3,000 pounds per surface acre. It should be kept in mind, also, that usually less than 4% of this total nitrogen becomes available for crop use during any one season. Missouri uses 2% in their calculations.

The greatest loss of soil nitrogen occurs when the virgin soil is put into cultivation. Myers et al (1943) reported losses of about 33% of the soil nitrogen under dry land conditions in Kansas during the first 10 to 15 years. Jenny (1933) reporting on soils of the midwest showed that nitrogen losses were as follows: Losses of 25% during the first 20 years of cultivation; 10% during the next 20 years; and 7% during the next 20 years; or a total of about 42% in 60 years.

Unpublished data from the Bureau of Plant Industry, Soils and Agricultural Engineering, USDA, show that in the Great Plains states nitrogen content of soils has decreased 64% under poor management practices to slightly on the plus side for the best management practices. Under most practices, soil nitrogen has decreased from 20 to 50 percent.

Table 1 shows a general average of losses in soil nitrogen in a number of states.

Nitrogen Removed in Harvested Crops

Large quantities of nitrogen are removed annually in harvested crops. From an extensive study in 1947, Mehring and Parks found that 100 principal crops removed 5,211,000 tons of nitrogen. Of this amount, only 726,000 tons were returned in the form of fertilizers and an estimated 1,300,000 tons in manure. Thus for the United States, about twice as much nitrogen is removed by crops as is returned in such important and common practices as fertilizers and manures.

A further study of this report shows that 20 pounds of nitrogen is removed per acre on the average by harvested crops in the United States. The figures by regions is given in table 2.

In this connection, it is interesting to compare the amount of nitrogen returned per acre in fertilizers and manures. On the average, in 1947, each acre of harvested crop land received only 4 pounds of nitrogen from fertilizers and 7.4 pounds from manures. The proportion of nitrogen coming from fertilizers and manures varied widely for different sections of the country as reported in Table 3.

In the South Atlantic region, fertilizers supplied twenty pounds of nitrogen per acre and manure only 1.6 pounds. Whereas in the East North Central region, manures supplied 17 pounds and fertilizers only 2 pounds. In most of the country, fertilizers supply less than one-third of the nitrogen added to harvested crop land in the form of fertilizers and manure.

TABLE 8
AVERAGE AMOUNT OF NITROGEN FROM FERTILIZERS USED PER ACRE OF CORN

Region	Average Lbs. Nitrogen Per Acre
Northeastern	14
Southern	15
North Central	3
Western	3
United States	7

TABLE 9
NITROGEN CONSUMPTION IN THE UNITED STATES

Period	Tons Nitrogen (N)
1900	62,000
1910	146,000
1920	228,000
1930	377,000
1940	419,000
1950-51	1,285,000

Nitrogen Losses by Soil Erosion and Leaching

In 1936, Lipman and Conybeare estimated soil nitrogen losses to be as follows: 25.09 pounds per acre from harvested crops, 24.2 pounds from erosion, and 23.0 pounds from leaching. Thus, we see the magnitude of losses from erosion and leaching in comparision with nitrogen removed by harvested crops. Fortunately, remarkable progress has been made in soil and water conservation in recent years, which helps account for the upward trend in crop yields. However, erosion will always be a constant threat which we must be prepared to meet.

Erosion takes the topsoil which is highest in nitrogen. Reports from Missouri show that soils cropped to corn continuously for 10 years lost 50.9 tons of soil per acre annually, compared to only a trace of soil lost from land in continuous bluegrass.

Large quantities of nitrogen are lost each year by leaching in the humid areas. This is especially serious in the light sandy soils of the South and along the Atlantic coast. Losses by leaching have been estimated to vary annually from 100 pounds per acre on bare sandy soils to only a few pounds per acre on heavy soils covered with grass or other close growing crops.

Solving the Soil Nitrogen Problem

The challenge today is to put into practice on all farm lands sound land use programs which supply enough nitrogen to maintain and replenish active organic matter and, at the same time, maintain high levels of crop production. This is easier said than done, but it can be done.

It is very difficult, if not impossible, to permanently increase the nitrogen and organic matter content of the soils in large areas of our country. Some soils have reached an equilibrium with the prevailing climatic and cultural conditions, but are still potentially very productive with proper treatment. Other soils

are losing nitrogen and organic matter at a rapid rate, but this downward trend can be stopped and nitrogen content maintained at a fairly high level.

Likewise, farming today must be run on a business basis to be successful. Therefore, the trend is towards higher production per acre, thus reducing the unit cost per bushel of corn, of wheat or pound of cotton. This means that the soil must be in good tilth and at the same time growing crops must be supplied enough nitrogen and other essential nutrients so that maximum economical yields can be produced on each acre.

In my opinion, no single practice such as growing legumes, strip cropping, rotation of crops, liming, or the use of fertilizer will be the salvation. A sound program including a combination of many practices adapted to the particular soils and crops will be necessary. I shall briefly discuss some of the outstanding points particularly as they relate to nitrogen and increased crop production.

Crop Rotation

It has long been known that growing cultivated crops continuously on the same land caused losses of soil nitrogen, soil structure or tilth and lower crop yields. On the other hand, proper rotations including legume crops tend to maintain or increase the nitrogen content of the soil, give better soil tilth and increase crop yields. Results in Table 4 from the Ohio Experiment Station will illustrate the point.

These results show how different rotations will increase yields and, at the same time, restore nitrogen on this particular soil type. Rather low rates of fertilization were used in this experiment and chances are that higher rates of fertilization would have been very beneficial.

In the South, large areas are planted to winter legumes, which add nitrogen and increase crop yields. Winter legumes turned under increased cotton yields, varying from 173 to 870 pounds of seed cotton per acre, with an average of 465 pounds. These increased yields correspond to the use of 17.7 to 62.5 pounds of nitrogen per acre or an average of 37.6 pounds.

Corn yields following winter legumes were likewise increased. The increases ranged from 13 to 43 bu. per acre.

In the United States, legumes by biological fixation, supply more nitrogen to the soil than any other source. Much more than is supplied by farm manures and fertilizers combined. We should grow more le-

gumes in the rotation. Not only for the nitrogen as such, but for the beneficial effects of legumes in improving soil tilth and aiding in soil and water conservation. It should be emphasized, however, that legumes should be adequately fertilized for successful results. On many soils, experiment stations recommend applying nitrogen at time of planting, in addition to mineral fertilizers, in order to improve the stand and give the legume crop a good start.

In recent years, emphasis has been placed on the advantages of deep-rooted legumes in the rotation, such as alfalfa, sweet clover, lespedeza, serecia and kudzu. These legumes have long-lasting results and the tap roots materially improve the soil tilth. Table 5 gives the pounds of roots produced by different crops:

Crop Residues

Too little attention has been given in the past to the utilization of crop residues in building soils and increasing crop production. Enormous quantities of corn stalks, cotton stalks and straw from small grain are burned or removed from the land annually. These low-nitrogen organic materials need extra nitrogen in the soil during decomposition, but all of the nitrogen they contain, as well as any added to speed their decay, is ultimately made available to crops. Many farmers in the midwest are chopping their corn stalks and returning them to the soil and adding large amounts of commercial nitrogen before turning them under. The results, I believe, will be spectacular. The important thing is to add enough nitrogen to do the job. Table 6 shows the amount of humus formed in the soil from the decomposition of 7,000 lbs, of different crop residues.

In a paper discussing organic matter and nitrogen content of Illinois soils as influenced by management, Lee and Bray gave the following conclusion:

"Differences in organic matter between the checks and the treated plots indicate that organic matter could be maintained or built up, provided sufficient nitrogen and other soil nutrients were present. The inability of the soils studied to maintain or increase their organic matter content is, therefore, ascribed primarily to addition of insufficient nitrogen, to these otherwise fertile soils, to balance crop removal and leaching losses."

Farm Manures

Farm manure is a major source of nitrogen for crop production in the United States and supplies far more nitrogen than is derived from fertilizers. According to Mehring and Parks, 1,370,000,000 tons of manure were produced in 1947, but only 15 percent was utilized in crop production. Even then, manure supplied 1,300,000 tons of nitrogen for crop use. More efficient care and handling of manure would add enormously to crop production and soil conservation.

Use of Nitrogen Fertilizers

Even with more efficient use of manures, legume cover crops and better rotations, we cannot build our soils and increase crop production without the use of more commercial nitrogen fertilizers. Most of our soils are low in nitrogen and crop requirements for nitrogen are high. The use of nitrogen fertilizers offers a quick and simple method of increasing crop production. Furthermore, farmers are more interested than ever before in producing maximum economical yields per acre and total crop production must be increased in order to feed and clothe our growing population. According to the U. S. Department of Agriculture, five tons of nitrogen will produce 100 tons of corn; 100 tons of corn will produce 20 tons of meat which will provide 150 pounds per person for 266 people each year.

Farmers, throughout the country, are realizing how fertilizer nitrogen will increase crop yields. Three times as much nitrogen was used last year as was used in 1940.

Table 7 gives the amount of nitrogen used in various regions of the country for the year ending June 30, 1950. Heaviest consumption was in the Far West and Southern states, where the soils are very low in nitrogen. California was the heaviest consuming state with North Carolina, second, and Mississippi, third. California used more nitrogen than the states of Ohio, Indiana, Illinois, Michigan and Wisconsin combined.

Crops Require Large Amounts Of Nitrogen

Nitrogen is known as the "growth element" and most crops require more nitrogen than any other element. A 100 bushel crop of corn requires about 160 pounds of nitrogen. Also since plants have peak growing periods it is essential that ample nitrogen be available during this period for maximum production. Furthermore, better crop varieties are being produced which will enable crops to utilize more nitrogen. Hybrid corn and small grains with stiffer straw, for example.

How Well Are Crops Fertilized With Nitrogen?

In October 1951, a report by the Fertilizer Work Group of the National Soil and Fertilizer Research Committee showed that, on the average, for the United States only 4 pounds of nitrogen was used per acre from fertilizers on all crops. This is a very small amount of nitrogen when compared to the amount that should be used for maximum crop production and the amount used in some other countries. Holland, for example, uses about 50 pounds of nitrogen per acre per year. To better illustrate how little fertilizer nitrogen is used per acre in the United States, Table 8 gives the average amounts of nitrogen from fertilizers that are applied to corn in various regions. The average amount ranges from 3 to 15 pounds with a United States average of only 7 pounds per acre.

Use of More Fertilizer Nitrogen Will Increase Crop Yields

There is no doubt about the use of more fertilizer nitrogen increasing crop yields when used in conjunction with other good cultural practices. In the South, two pounds of nitrogen will produce an extra bushel of corn and 2 to 3 pounds will do the same thing on millions of acres in other parts of the country. On the average, 3 to 6 pounds of nitrogen will produce an extra

(Continued on page 44)

coverage alone is not enough

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Flue-cured tobacco
FERTILIZERS OF THE FUTURE

By F. W. PARKER
Bureau of Plant Industry, Soils, and Agricultural Engineering
Agricultural Research Administration
U. S. Department of Agriculture
Beltsville, Maryland

Major changes in fertilizer for flue-cured tobacco can be expected in the near future. Some of the new fertilizers will probably be available to farmers in 1952 or 1953. These fertilizers will be better than the present standard grades, and the farmer's tobacco fertilizer bill will be substantially lower.

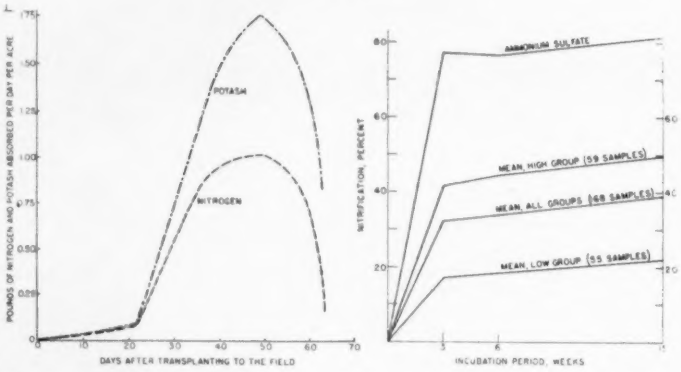
The prospective changes in fertilizers will be based on results of three different but related lines of research, namely:

1. Studies on the plant-nutrient requirements of flue-cured tobacco in relation to yield and quality.

2. Studies of the fertility of soils used to produce tobacco, and

3. Investigations on the composition, quality and technology of tobacco fertilizers.

Each of the three lines of investigations will be considered briefly before discussing tobacco fertilizers of the future.



Left: Fig. 1. Shows rate of absorption of nitrogen and potash by flue-cured tobacco. Fig. 2 is a comparison of the nitrification in 3-, 6- and 15-week incubation periods at 30° C. of the nitrogen in ammonium sulfate and the water-insoluable nitrogen in mixed fertilizers.

Plant-Nutrient Requirements

The Virginia Agricultural Experiment Station (4) conducted a very thorough study of the absorption of plant nutrients by tobacco in 1939 and 1940. The crops were grown on Granville sandy loam at Chatham, Virginia. They received a 3-10-6 fertilizer at the rate of 900 pounds per acre. The average yield of 36 plots was 1,090 pounds of leaf and 404 pounds of stalk per acre. The yield and composition of the crops were determined at four stages of growth, 21, 35, 49, and 63 days after transplanting.

The Virginia investigators found that the 1,494 pounds of leaf and stalk contained 30 pounds of nitrogen, 9 pounds of phosphorus (P_2O_5), 54 pounds of potassium (K_2O), 43 pounds of calcium (CaO), 11 pounds of magnesium (MgO), and 22 pounds of sulfur (SO_3). The phosphorus content is low in comparison to constituents other than magnesium. Potassium is higher than any other nutrient. A high potassium content is essential for high-quality leaf. Calcium, magnesium, and sulfur are often called secondary elements but from the standpoint of plant composition and essentiality for growth, they are just as important as nutrients as nitrogen, phosphorus, and potassium. Definite provision must be made for their addition in the fertilizer or otherwise in the soil-improvement program.

The study of the time of nutrient absorption by the crop showed that the plants absorbed only 6 percent of their nitrogen in the first three weeks and 8 percent in the last two weeks. Eighty-four percent of the nitrogen was absorbed in four weeks—21 to 49 days after transplanting. The other plant nutrients were absorbed somewhat more slowly at first, and absorption continued later in the growing period than in the case of nitrogen. Since the absorption pattern was similar for phosphorus, potassium, calcium, magnesium, and sulfur, the percentage data have been averaged. Only three percent of these nutrient elements was absorbed in the first 3 weeks, 69 percent in the next 4 weeks, and 27 percent in the last 2 weeks of growth.

Figure 1 shows the daily absorption of nitrogen and of potassium during the 63-day growth period. Note the very high rate of nitrogen absorption in the 30 to 55-day period. Potassium absorption was highest during the 33 to 60-day period and was still at the rate of 1.0 pound per day on the 60th day. The ideal fertilizer would be one that would supplement the soil in supplying the nutrients in the quantity and at the time needed by the crop.

It is apparent from the Virginia data that large quantities of available nitrogen and other nutrients are utilized during the three to seven-week period. An abundance of minerals, especially potassium, is essential throughout the entire growing period, but leaf quality will be improved by the development of a slight deficiency of nitrogen during the last weeks of growth. While nutrient uptake is low the first three weeks, a good supply of all nutrients in the limited root zone is essential for the rapid development of the young plant.

A comparison between the quantity of nutrients in a tobacco crop and that supplied in current fertilizer practice indicates that the fertilizer program may not be well balanced. Table 1 shows the estimated quantity of each nutrient required for production of a 1,500-pound crop of good-quality leaf. The nutrient content of roots and stalks and of the leaf is shown separately. The former are left in the field, and a portion of nutrients may be used by subsequent crops. The table also shows the quantity of the same nutrients applied in 1,200 pounds of an average 3-9-6 fertilizer. The last column shows the difference between the nutrient content of the leaf and the quantity applied. There is a reasonably good balance between additions and removal of nitrogen, potassium, and magnesium. On the other hand, phosphorus additions are 15 times the quantity removed, calcium and sulfur additions are 4 and 10 times the quantity removed by the crop. If the comparison is made between the nutrient content of the entire crop and additions in the fertilizer, it still seems possible that the latter carries excessive amounts of phosphorus, calcium, and sulfur. It would appear, therefore, that the possibility of reducing the applications of phosphorus, calcium and sulfur should be considered. In doing this, however, allowances must be made for differences in efficiency of utilization and in the

TABLE 1
NUTRIENT CONTENT OF FLUE-CURED TOBACCO, ADDITIONS IN FERTILIZER AND NET REMOVAL —1,500 LBS. LEAF PER ACRE

Nutrient element	Entire crop Lb.	Stalks and roots Lb.	Removed in leaf Lb.	Added in 1200 lbs. 3-9-6 Lb.	Net Addition[1/] Lb.
Nitrogen (N)	51	18	33	36	+ 3
Phosphorus (P_2O_5)	12	5	7	108	+101
Potassium (K_2O)	103	53	50	72	+ 22
Calcium (CaO)	69	22	47	204	+157
Magnesium (MgO)	26	10	16	24	+ 8
Sulfur (SO_3)	36	15	21	210	+189

1/ Column 5 minus column 4.

TABLE 2
FERTILITY OF NORTH CAROLINA TOBACCO SOILS

Component	Percent of 11,868 samples testing— Very low	Low	Medium	High	Very high
Organic Matter	51	30	12	4	3
Phosphorus	3	8	7	18	64
Potassium	5	46	32	9	8
Calcium	7	21	70	2	0

	Percent in pH Range				
	5.0 or less	5.1-5.5	5.6-6.0	6.1-6.5	6.6 or above
	7	46	38	8	1

quantity that might be supplied by the soil.

Soil Fertility

All of the flue-cured tobacco-producing States operate soil-testing laboratories and have accumulated a great deal of information on the fertility of soils being used for tobacco production. Results on 11,868 samples of tobacco soils examined by the North Carolina Soil Testing Laboratory in 1949-50 (6) are summarized in Table 2. This study certainly gives the best information available on the fertility of tobacco soils in North Carolina.

The organic content of 81 percent of the tobacco soils is very low or low. Only 7 percent are rated high or very high. These soils, therefore, will not provide much nitrogen for the crop. Its requirements must be met with fertilizer. This is fortunate in some respects for it makes possible the production of tobacco of low nitrogen content, one of the essentials of quality in flue-cured tobacco. Extensive experiments have shown that on these soils low in organic matter, 36 to 40 pounds of nitrogen in the fertilizer will give a good yield of high-quality leaf. More nitrogen will increase yield but may reduce quality and value per acre.

The level of available phosphorus in soils planted to tobacco is usually very high. Eighty-two percent of all soil samples fall in the very high or high group with respect to available phosphorus. Only 11 percent were classed as low or very low. The high available phosphorus level is the direct result of long-continued fertilization with relatively high-phosphorus fertilizers. The 101 pounds of phosphorus (P_2O_5) not removed in the crop (Table 1) remain in the soil. It is not lost by leaching. When excess phosphours applications are repeated frequently the amount accumulated becomes quite large. Many investigations, including recent studies with radioactive phosphorus, clearly demonstrate that a portion of the residual phosphorus is available to later crops. As the amount of residual phosphorus accumulates, it finally reaches a level where crops no longer respond to heavy phosphorus fertilization. That is the situation on older tobacco soils, especially in the Coastal Plain. It is estimated (3) that a 50-percent reduction in the phosphorus fertilization of tobacco would only reduce production in North Carolina by 0.7 percent. Most of that reduction would be on the small acreage where the soils tested are very low, low or medium in available phosphorus. The same estimates indicate that complete elimination of phosphorus would reduce yields 17 percent. It is clearly evident, therefore, that the rate of phosphorus fertilization might be reduced. On the other hand, applications are needed for early vigorous growth of the transplant before it develops a vigorous root system and to maintain high yields. The rate of application should exceed the rate of crop removal so that soil improvement may continue.

Seventy-eight percent of the North Carolina tobacco-soil samples were low or medium in available potassium. Only 17 percent were high or very high. It is evident, therefore, that despite rather heavy and frequent fertilization,

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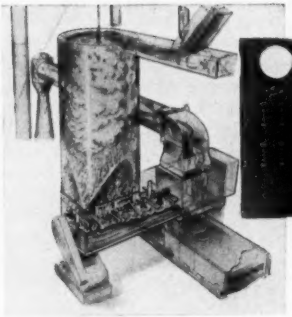

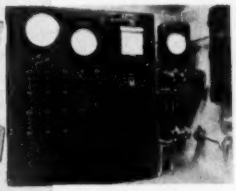

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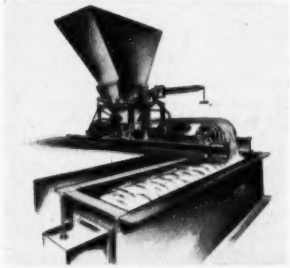

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TABLE 3
NUTRIENT ELEMENTS REMOVED BY 1,500 LB. CROP AND SUGGESTED AMOUNTS THAT SHOULD BE SUPPLIED BY FUTURE FERTILIZERS (LB. PER ACRE)

Nutrient element	Removed in 1,500 lb. leaf	Supplied by fertilizer	Difference
Nitrogen (N)	33	36	+ 3
Phosphorus (P_2O_5)	7	40	+33
Potassium (K_2O)	50	90	+40
Calcium (CaO)	47	75	+28
Magnesium (MgO)	16	30	+14
Sulfur (SO_3)	21	50	+29
Chlorine (Cl)	30	40	+10

TABLE 4
COMPARISON OF 3-9-6 AND IMPROVED FERTILIZERS OF INDICATED GRADE WITH RESPECT TO NUTRIENTS SUPPLIED, COMPOSITION, AND RELATIVE COST

Nutrient	3-9-6 1200 Lbs.	4-8-10 900 Lbs.	5-8-12 720 Lbs.	6-6-15 600 Lbs.
	Lb/A	Lb/A	Lb/A	Lb/A
Nitrogen (N)	36	36	36	36
Phosphorus (P_2O_5)	108	72	57	36
Potassium (K_2O)	72	90	86	90
Calcium (CaO)	204	140	116	71
Magnesium (MgO)	24	34	32	40
Sulfur (SO_3)	210	208	66	144
Chlorine (Cl)	36	34	36	36
	Lb/T	Lb/T	Lb/T	Lb/T
Acidity ($CaCO_3$) equiv.)	None	None	60	None
Organics	400	None	None	None
Filler	210	220	None	None
Dolomite	136	266	300	500
Relative cost per acre	100	80	70	65

potassium, unlike phosphorus, does not accumulate in those soils. This is due to the large quantity of potassium removed by the crop and some loss leaching. Liberal potassium fertilization, therefore, must be continued. Experimental results from several States indicate that for good yields of high-quality leaf, the fertilizer should supply 70 to 100 pounds of potassium (K_2O) per acre.

The calcium status of these soils is relatively good—70 percent are medium in calcium and only 7 percent are very low. Likewise, the pH status is generally satisfactory—84 percent of all soil samples were between pH 5.0 and 6.0. A higher pH is undesirable as it tends to increase tobacco diseases. Only 12 percent of the soils need liming, and a rate of 1,000 to 2,000 pounds of limestone per acre is sufficient.

The North Carolina soil data, as well as the data on plant requirements for nutrients, indicate that the quantity of phosphorus, calcium, and sulfur in fertilizers might be reduced. Less extensive soil test data from other States tend to confirm this conclusion.

Fertilizer Composition and Quality

The standard tobacco fertilizer is 3-9-6 and contains 2 percent magnesium (MgO), not more than 3 percent chlorine (Cl), and with about one-third of the nitrogen derived from natural organic materials. The Phosphorus is from super-phosphate, potassium from potassium chloride and potassium sulfate, and nitrogen is from ammonium sulfate and ammonia solutions in addition to the natural organics. The 3-9-6 tobacco fertilizer, containing less than 20 units of plant-food, is the lowest-grade fertilizer that is now sold in large tonnage. Approximately 800,000 tons were sold in 1949-50, chiefly in four States — Virginia, North Carolina, South Carolina, and Georgia.

There has been a long standing demand that a portion of the nitrogen in tobacco fertilizers be in natural organic forms. As a measure of the nitrogen in these forms, it is customary to guarantee the water-insoluble nitrogen content of tobacco fertilizers. Natural organic materials vary widely in composition and nitrogen availablity. It seemed advisable, therefore, to study the quality of water-insoluble nitrogen in a large number of representative samples of tobacco fertilizers. Such a study was made on 168 official samples furnished by cooperating State fertilizer-control officials (2).

The results are shown in Figure 2. As an average of all samples, the potential fertilizer-efficiency of the water-insoluble nitrogen was only one-half the efficiency of the water-soluble nitrogen of ammonia sulfate. The quality of the insoluble nitrogen varied from good in fertilizers from Georgia to very poor in the Virginia samples. The indications are that the decline in quality from Georgia through the Carolinas to Virginia was associated with a decreased use of oilseed meals, such as cottonseed meal, and an increased use of industrial wastes including process tankage.

It has been thoroughly established in extensive field experiments (1,4,5) that water-soluble nitrogen materials are usually better sources of nitrogen for tobacco than even the good-grade organics such as cottonseed meal and animal tankage. The quality of nitrogen and time of availability to the crop rather than the source of nitrogen determines the yield and quality of the crop.

The study of tobacco fertilizer was extended to include the determination of the quantity of sand and dolomite in the fertilizer. As an average the samples contained approximately 210 pounds of sand and 136 pounds of dolomite per ton of fertilizer.

The studies on the composition of tobacco fertilizer, therefore, give this general picture. A ton of 3-9-6 contains 400 pounds of organic materials of low to medium quality. There are 210 pounds of sand or other inert material. One hundred

and thirty-six pounds of dolomite were included to furnish calcium and magnesium and to correct acidity produced by the fertilizer. There remains, therefore, 1,254 pounds of other fertilizer materials that supply all of the phosphorus, all of the potassium and two-thirds of the nitrogen, as well as substantial quantities of calcium, sulfur, and magnesium. It would be a 3-14-10 fertilizer if not diluted with organics, filler, and dolomite. As indicated in Table 1, the fertilizer carries somewhat more phosphorus, calcium, and sulfur than is required by the tobacco crop. In planning new fertilizers, therefore, consideration should be given to the possibility of reducing the amount of phosphorus, calcium, and sulfur. There is good evidence to indicate that if the amount of calcium were reduced it would be easier to increase the potassium content of tobacco leaf and thereby improve its quality. Quality would be further improved by a moderate increase in the potassium content of the fertilizer.

Improved Tobacco Fertilizers

Having considered the nutrient requirements of tobacco, the fertility of tobacco soils, and current fertilizers and fertilizer practices, we are now ready to consider fertilizer improvement. What should the fertilizer furnish the tobacco crop? The amounts of nutrients indicated in Table 3 would be adequate for the production of 1,500 pounds of high-quality leaf when grown on soils of the fertility indicated by the North Carolina soil-test data. The chief differences between the suggested application and current practice are (a) substantial reductions in the quantity of phosphorus, calcium, and sulfur and (b) a 25-percent increase in potash. The quantity of nutrients removed in 1,500 pounds of leaf is shown for comparison and the difference for each nutrient is shown in the last column of the table. In each case the quantity suggested for application in the fertilizer exceeds the amount that would be removed in 1,500 pounds of leaf. With the exception of nitrogen and potash, the quantity suggested is greater than the nutrient content of the entire crop as given in Table 1.

The indicated quantity of nutrients, or larger amounts, can be supplied by several different fertilizers applied at appropriate rates. Three possibilities are indicated in Table 4 and are compared with current practice, 1,200 pounds of 3-9-6 per acre. The comparisons also indicate the quantity of organics, filler, and dolomite in each fertilizer and the relative cost per acre. The latter is estimated from current wholesale cost of fertilizer materials and manufacturing and distribution costs. The three suggested fertilizers, 4-8-10, 5-8-12, and 6-6-15, are formulated with all nitrogen from water-soluble materials. This will increase the efficiency of the nitrogen, re-

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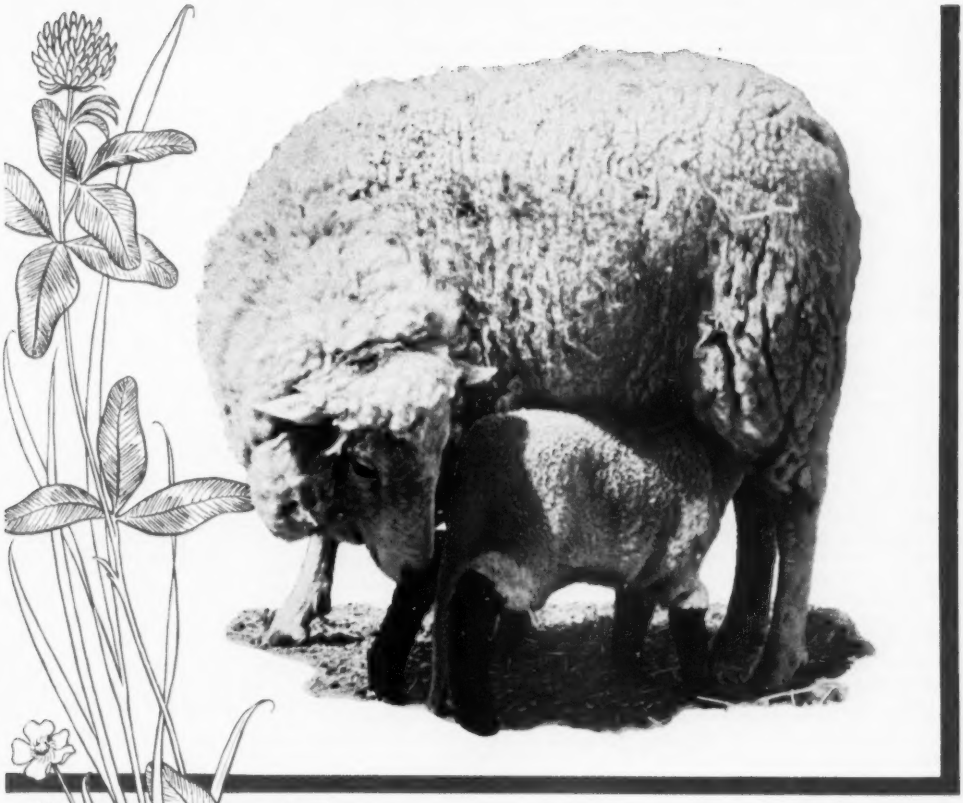

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duce costs substantially, and make possible increasing the plant-nutrient content of the fertilizer. Each fertilizer would provide 10 pounds of soluble magnesium (MgO) per acre and the recommended quantity of chlorine (Cl).

The 4-8-10 grade, currently recommended in North Carolina, is a very good fertilizer but still provides more calcium, sulfur, and phosphorus than is required. It would normally contain a moderate quantity of filler: Its use will reduce tobacco fertilizer costs about 20 percent.

The 5-8-12 grade used at the rate of 720 pounds per acre is an excellent and very economical fertilizer. It furnishes the suggested quantity of all plant nutrients with somewhat larger quantities of phosphorus, calcium, and sulfur. All filler would be eliminated but no triple superphosphate would be needed if it were formulated slightly acidic as in the example indicated. The use of the 5-8-12 instead of the 3-9-6 grade would reduce the weight of fertilizer handled on the farm by 40 percent and would reduce the cost of fertilizer by about 30 percent.

The 6-6-15 grade furnishes approximately the quantity of all nutrients suggested in Table 3 but with a considerable excess of sulfur. The phosphorus may be a bit low but this could be corrected by going to a 6-8-15 fertilizer which would give 48 pounds of P_2O_5 per acre. These fertilizers, 6-6-15 or 6-8-15, seem to approach the maximum concentration and economy possible under current fertilizer technology and our existing knowledge of plant requirements and soil fertility. The production of 8-8-20 or 8-10-20 fertilizers to be used at the rate of 450 pounds per acre would be possible if all or a substantial proportion of the dolomite were applied directly to the soil rather than as a constituent of the fertilizer. This would be a major change in practices and should not be adopted until further research has been conducted.

We may anticipate that the 6-6-15 and possibly the 5-8-12 type of fertilizer would be granulated. This would assure excellent physical properties and facilitate accurate distribution and placement of the fertilizer.

It is recognized that introduction of new grades involving use of smaller applications of higher analysis fertilizers will require educational work. However, progress made in use of higher analysis fertilizers for other crops indicate that farmers are willing to accept improved products. Increasing labor and transportation costs and the need for increased efficiency of farm operations are inducements for such changes.

Summary

The plant-nutrient requirements of flue-cured tobacco, the fertility of soils used for its production, and the technology of tobacco fertilizer production have been briefly reviewed. Several fertilizers of increasing concentration, 22 to 29 percent (N-P_2O_5-K_2O), are suggested as alternatives to the current use of the 3-9-6 grade. The use of the suggested fertilizers would offer the following advantages to farmers:

1. A better fertilizer since all nitrogen is derived from soluble nitrogen materials, more potassium is provided, and its utilization is increased by a reduction in the calcium content of the mixture.

2. A reduction in labor, since the rate of fertilization would be reduced from 1,200 to as low as 600 pounds per acre.

3. A reduction of 20 to 35 percent in the acre cost of fertilizer.

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SOUTH CAROLINA SOCIETY GIVES GOLD KEYS IN CORN CONTEST

We have here a letter of appreciation from Herbert B. Davis, Spencer Chemicals, president of the South Carolina Plant Food Educational Society, enthusiastic about our proposal to give wide publicity to the need for plant food educational organizations, such as the one he heads, and the one in Georgia on which we reported last month. March 19 the South Carolina society is making its State Wide Corn Contest Awards, Mr. Davis reports, and will present gold keys to those making the 100 Bushel Club. This will be done at a luncheon at the Jefferson Hotel in Columbia, South Carolina.

In June the organization is sponsoring four general farm tours jointly with the extension service at Clemson. And during September they plan their annual meeting, with a good program planned.

The 100 Bushel Club was organized in 1948 with 21 members. This, and the 1949 contest, led to the formation of the Society, which annually offers $1750 in cash prizes and in 1951 awarded gold keys to 111 new winners.

MARKETS

Tax Sales Dip In December

December, 1951, sales of fertilizer tax tags and reported fertilizer shipments were off 195,025 equivalent short tons compared with the same month of 1950, according to The National Fertilizer Association. Reports from fertilizer control officials in the 13 reporting States indicate that December, 1951, tag sales, equivalent to 522,228 tons of fertilizer, were 27.2 percent below the indicated sales of 717,253 tons in the like month a year ago.

Tag sales and reports of shipments during the first 11 months of 1951 amounted to 9.9 million tons, 6.5 percent above 1950 sales of 9.3 million tons. In order to insure receipt of fertilizers by the planting season, farmers must be encouraged to take delivery now.

FERTILIZER TAX TAG SALES AND REPORTED SHIPMENTS 1/
(In Equivalent Short Tons)
Compiled by The National Fertilizer Association

STATE	December		January-November		July-November	
	1951	1950	1951	1950	1951-52	1950-51
N. Carolina	1/	1/	1,687,448	1,708,744	240,233	283,950
S. Carolina	57,170	94,856	881,433	918,970	202,122	213,355
Georgia	74,132	62,248	1,196,402	1,173,510	178,091	217,205
Florida	97,185	120,795	1,108,026	976,573	453,079	406,425
Alabama	33,360	59,025	1,038,940	992,284	175,615	167,989
Tennessee	7,710	16,316	590,905	475,940	199,762	103,202
Arkansas	13,314	22,201	401,777	343,862	50,641	53,732
Louisiana	8,163	13,226	294,460	265,482	59,657	61,001
Texas	35,329	37,877	532,357	549,762	186,320	218,232
Oklahoma	1/	1/	147,250	137,430	58,682	49,118
TOTAL SOUTH	326,363	426,544	7,878,998	7,542,557	1,804,202	1,774,209
Indiana	68,815	148,725	866,130	812,928	414,560	347,439
Kentucky	68,733	76,175	483,015	530,995	132,680	131,588
Missouri	58,317	65,809	679,272	432,035	232,271	172,027
TOTAL MIDWEST	195,865	290,709	2,028,417	1,775,958	779,511	651,054
GRAND TOTAL	522,228	717,253	9,907,415	9,318,515	2,583,713	2,425,263

1/ Oklahoma and North Carolina report tax tag sales 30 days after the end of the current month. Oklahoma and North Carolina tag sales for November, 1951 represent 6,908 and 55,028 tons respectively, compared to 4,633 and 87,037 tons during November, 1950. Virginia reports quarterly.

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LION ANHYDROUS AMMONIA—Manufactured in Lion's modern plant to an 82.25% nitrogen content under accurate chemical control, the uniformity and high quality of this basic product are assured.

LION AQUA AMMONIA—This product is available to manufacturers for use in the formulation of mixed fertilizers or for sale as direct application material. Normally about 30% ammonia, its content can be controlled by order to suit your needs.

LION NITROGEN FERTILIZER SOLUTIONS—Made specifically for the manufacturing of mixed fertilizers, these products supply both ammonia nitrogen and nitrate nitrogen in the ratios desired. They are easily handled and available in three types designed for varying weather conditions, and for formula requirements in the production of fertilizers that cure rapidly, store well and drill evenly.

LION AMMONIUM NITRATE FERTILIZER—The improved spherical white pellets in this product contain a guaranteed minimum of 33.5% nitrogen. They flow freely, resist caking and store much better. Lion Ammonium Nitrate Fertilizer is shipped in 100-pound, 6-ply bags with two moisture-proof asphalt layers.

LION SULPHATE OF AMMONIA—This new, superior-type sulphate is guaranteed to contain a minimum of 21% nitrogen. Through special conditioning of the larger crystals, moisture and free acid content is greatly reduced. These factors, together with the special coating applied, make for greater resistance to caking in shipment or in storage. This product flows freely. It is shipped in bulk and in 100-pound, 6-ply bags laminated with asphalt.

Serving Southern States

Technical advice and assistance to fertilizer manufacturers in solving their manufacturing problems is available for the asking...just write.

LION

LION OIL COMPANY

Chemical Division • El Dorado, Arkansas

savings:

FULTON COTTON BAGS

1 *Fulton Cotton Bags represent a real saving in time and labor because they handle so much easier. Without "pampering" they can be stored and moved more quickly — reducing your handling costs . . . and their stronger, sturdier construction means far less waste from breakage! Fulton Cotton Bags mean a savings for YOU right in your own plant!*

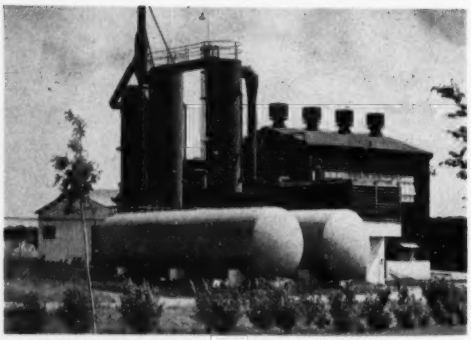
2 *These same savings apply in your dealers' storerooms. And here, Fulton's attractive band labels put in an extra sales lick for you, keeping your brand name prominently displayed on a container you can be proud of . . . that can take repeated handlings and still come out on top!*

3 *In your customers' hands there are further savings because the quality sheeting or osnaburg in Fulton Cotton Bags is re-used profitably in making dozens of practical, valuable household items. Thus Fulton Cotton Bags are a saving for your customers because they save on container costs!*

Get the FULL story on Fulton Cotton Bag savings from your nearest factory branch.

Fulton BAG & COTTON MILLS

Atlanta • St. Louis • Dallas • Denver • Minneapolis • New Orleans • Kansas City, Kans. • Los Angeles • New York City



USDA Reports

(Continued from page 22)

acid to produce sufficient superphosphates to balance with the expected supply of nitrogen and potash must be taken into account. It is estimated that during the fiscal year 1951-52 1,808,000 long tons of sulfur will be required for agricultural purposes and that approximately 1,158,000 long tons will be available, which is 650,000 long tons less than agricultural needs.

There are new facilities being installed, and in some cases now operating, to recover sulfur from various sources. The overall demand for sulfur-sulfuric acid has greatly increased during 1951. Methods of conservation of crude sulfur by substitution of other sulfur bearing materials have been recommended, as well as the use of alternate materials where applicable.

General: The Department's program for the expansion of fixed nitrogen production capacity by 900,000 tons of N by 1955 has been approved by the Defense Production Administration. A number of new synthetic ammonia plants which are expected to produce a substantial tonnage of nitrogen compounds for agriculture are now in various stages of building; others are scheduled for later starts. Every effort is being made to complete the entire nitrogen expansion program at the earliest date possible. At the best but little contribution from these new facilities can be expected before late 1953 or 1954. In the interim, reactivation of the Morgantown plant is expected to provide some addition to the supply.

There are two new potash mining facilities which over the next one or two years will add substantially to the domestic supply. One facility is now in production and will supply some material for use in 1952.

The PMA State Committees in cooperation with the technical subcommittees on fertilizers prepared reports on the estimated consumption and utilization of major plant food elements by crops and groups of crops during the year ending June 30, 1950. These reports have been summarized and included as a part of the 1951-52 preliminary fertilizer situation. It will be noted that 27.9 percent of the nitrogen, 22.6 percent of the P_2O_5, and 25.8 percent of the K_2O or about one-fourth of the major plant food elements used in 1949-50 were applied to corn, while cotton accounted for only nine percent of the total. Small grains and pasture crops were also heavy consumers of phosphate.

Nitrogen

(Continued from page 30)

bushel of wheat. In Wisconsin, 73 pounds of nitrogen per acre on pastures produced 20,103 pounds of milk compared to 5,440 pounds on the unfertilized area. At $3.00 per hundred for milk, this meant a return of $5.00 for each dollar spent for nitrogen.

The U. S. Department of Agriculture reports that 40 pounds of nitrogen per acre—now applied only to tobacco—would give spectacular returns in field crops if used with adequate supplies of other fertilizer nutrients. It would produce an additional 600 million bushels of corn, 200 million bushels of wheat—equivalent to present plantings of 14 million acres in each crop—and 400 million bushels of oats—equivalent to 11 million acres.

Nitrogen Needs

For the United States as a whole, nitrogen deficiency probably is limiting crop production more than any other nutrient element. The U. S. Department of Agriculture estimates that we need to use 500,000 additional tons this year, plus an increase of 100,000 tons annually for several years. Requirements by 1955-56 have been estimated to be about 2,351,000 tons annually.

Reports from Missouri show that in 1950, 90,000 tons of nitrogen were required to grow 180,000,000 bushels of corn on 4 million acres. After deducting the amount of nitrogen applied in fertilizers and green manures, it was estimated that the corn crop used 58,000 tons more nitrogen than was added.

In 1944, the Nebraska Experiment Station estimated that about 14,000 tons of nitrogen from fertilizers would be needed annually for postwar production. This figure was revised upward to 18,043 tons in 1947, and recently, Dr. H. F. Rhoades estimated that 80,000 tons of nitrogen will be used in Nebraska within 10 years.

Experiments in the South show that corn yields can be doubled or tripled with adequate use of nitrogen. On 50,512 corn demonstrations in seven states, the average yield was 66 bushels per acre compared with an average yield of only 25 bushels per acre in this area.

Thus, the need for nitrogen is rapidly increasing and more appreciated throughout the country, especially in the Midwest and Great Plains states.

Meeting the Fertilizer Nitrogen Needs

At present, there is a shortage of nitrogen for fertilizers, especially some solid forms in some areas, due to the unprecedented demand, even though more nitrogen will be used this year than ever before in history. However, the fertilizer industry always has met the demands for nitrogen in all normal periods, and the future looks bright. New production records have been set annually for the past nine years, and prospects are for an increase of five percent this year. Table 9 gives the record of nitrogen consumption since 1900 as reported by the U. S. Department of Agriculture. Note that nitrogen consumption has tripled in the 10-year period since 1940.

To meet the increased demand for nitrogen, fertilizer manufacturers are expanding production facilities as rapidly as possible. Plant construction has been hampered by the shortage of building materials, principally stainless steel, which is a scarce war material. In the past six months, the National Production Authority has announced that

16 new or expanded nitrogen plants, with an annual capacity of 620,800 tons of nitrogen are under construction or planned for immediate construction. In addition, NPA announced on December 14, 1951, that an additional 220,000 tons of nitrogen capacity would be developed by 1955, making a total capacity of 2,900,000 tons of nitrogen in 1955.

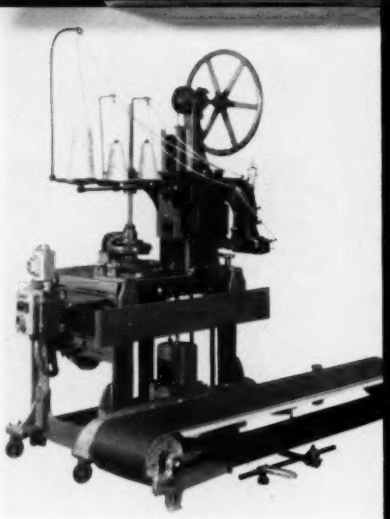
USDA PROPOSES BIG INCREASE IN FERTILIZER BY 1955

On page 48 of this issue is a report from USDA estimating the plant food needed in 1955 to sustain the level and pattern of production attainable in 1955. Based on this survey, state by state and region by region, the NFA has now issued data showing the expansion program USDA is "encouraging" in order to make available by 1955 these totals: Nitrogen, 2,185,000 tons; Superphosphate, 3,350,000 tons; Potash, 2,100,000 tons.

Breaking down the N total, 900,000 additional tons, USDA estimates as follows

Ammonium nitrate	160,000 tons N
Ammonium sulfate	110,000 tons N
Urea compounds	175,000 tons N
Ammonium phosphates	65,000 tons N
Nitraphosphates	175,000 tons N
Other chemicals	5,000 tons N
Nitrogen solutions	90,000 tons N
Ammonia for direct application	120,000 tons N

Pertinent to this forecast is a report of the Nitrogen IAC meeting late last month, which was told by NPA that the 23 certificates for domestic nitrogen producing facilities, now being reviewed, indicate a proposed expansion of one million tons of chemical nitrogen, or more than twice the goal to meet estimated 1955 requirements.



Union Special Machine Company, Chicago, announces two new machines of the Class 21800 table type bag closing variety—21800 P and 21800-R. Style P is designed for closing textile or paper bags using 80600 or 14500 heads. Style R is for use with Vibrox packer. Both make plain sewed or tape bound closures, and have a capacity of 2800 daily 100 pound bags. Bulletin 200, a 16 page booklet tells the story of Union Special's bag closing machines. Copies may be obtained by writing Union Special's sales promotion department, 400 N. Franklin Street, Chicago 10, Illinois.

Producing Nitrogen At Full Capacity!

Phillips is producing nitrogen fertilizer materials at full capacity. But even our tremendous rate of production isn't always sufficient to meet today's demand. We'll do our best for you. Keep us in mind if you need nitrogen in any form.

AMMONIUM SULFATE—Phillips *66* Ammonium Sulfate is a free-flowing 21% nitrogen material! Mixes easily! Uniform crystals resist caking! Ideal for high-analysis mixed goods! A fine direct application material!

AMMONIUM NITRATE—Phillips *66* Prilled Ammonium Nitrate contains 33% nitrogen. The small, coated prills or pellets resist caking . . . handle easily. Phillips *66* Prilled Ammonium Nitrate can be depended on for uniform, free-flowing properties and top-notch crop response.

NITROGEN SOLUTIONS—More N per dollar! Phillips *66* Nitrogen Solutions are well suited to the preparation of high-analysis fertilizers and the ammoniation of superphosphate. These three nitrogen solutions keep handling costs low . . . promote rapid, thorough curing!

ANHYDROUS AMMONIA—Tank car shipments of Anhydrous Ammonia (82% nitrogen) go out to Phillips contract customers from Phillips production facilities in the Texas Panhandle. Write our nearest district office for full information.

Phillips 66

PHILLIPS CHEMICAL COMPANY

A Subsidiary of Phillips Petroleum Company

FERTILIZER SALES DIVISION • BARTLESVILLE, OKLAHOMA

DISTRICT SALES OFFICES:

NORFOLK—610 Royster Bldg. • TAMPA—7 Terrace Office Bldg., 404 Marion St. • HOUSTON—604 City National Bank Bldg.
OMAHA—WOW Bldg. • AMARILLO—First National Bank Bldg. • LOS ANGELES—4521 Produce Plaza West • BARTLESVILLE—Adams Building

UNITED STATES DEPARTMENT OF AGRICULTURE

Estimates of Quantities of Commercial Plant Nutrients Used in 1950 and of Those Needed for Level and Pattern of Production Attainable in 1955

The data below were tabulated from reports of State Productive Capacity Committees in a Nationwide study undertaken cooperatively by the Land Grant Colleges and the Department of Agriculture to appraise the productive capacity of American agriculture in the mobilization period and the critical materials needed to achieve the production which the Committees believed to be attainable by 1955. These estimates indicate that 70 percent more fertilizer than was used in 1950 would be needed to achieve this level and pattern of production, including 93 percent more nitrogen, 54 percent more phosphoric acid, and 77 percent more potash.

State and Region	1950 (N) Nitrogen	1950 Phosphoric acid (P_2O_5)	1950 Potash (K_2O)	1955 Attainable Nitrogen (N)	1955 Attainable Phosphoric acid (P_2O_5)	1955 Attainable Potash (K_2O)
	Tons	Tons	Tons	Tons	Tons	Tons
Maine	12,870	20,593	22,470	15,980	25,307	26,587
N. H.	836	3,837	2,171	1,082	5,150	2,842
Vt.	1,521	6,911	3,758	2,323	10,414	6,032
Mass.	4,417	8,875	6,422	4,465	9,189	6,519
R. I.	649	1,554	1,337	877	1,730	1,556
Conn.	6,612	8,277	8,046	7,963	10,567	10,688
N. Y.	23,913	81,888	34,053	33,000	90,000	40,000
N. J.	11,951	24,953	20,890	18,964	44,731	45,811
Penn.	20,611	83,820	41,332	27,191	113,967	98,087
Del.	2,089	6,650	4,886	3,048	7,213	6,098
Md.	6,319	30,252	17,351	21,433	74,054	47,094
Northeast	91,788	277,610	162,716	136,326	392,322	291,314
Ohio	28,860	117,512	81,520	46,585	144,409	100,115
Ind.	34,491	130,464	97,291	141,002	227,462	200,218
Ill.	15,804	1/ 201,055	48,688	46,340	2/ 283,760	95,086
Iowa	13,616	48,336	12,736	70,069	103,105	34,943
Mo.	21,865	52,641	28,047	90,000	130,000	70,000
Corn Belt	114,636	550,008	268,282	393,996	888,736	500,362
Mich.	9,548	62,738	39,360	16,436	92,171	69,679
Wis.	12,671	49,601	51,243	45,162	105,702	116,250
Minn.	6,465	41,542	20,992	12,010	63,950	31,975
Lake States	28,684	153,881	111,595	73,608	261,823	217,904
Va.	26,862	80,906	43,723	35,877	104,159	63,568
W. Va.	2,250	17,000	4,450	3,700	24,500	6,200
N. C.	92,148	146,276	104,142	133,200	211,567	199,268
Ky.	21,758	75,221	27,198	28,270	96,505	35,915
Tenn.	23,343	56,885	28,834	32,728	68,070	43,547
Appalachian	166,361	376,288	208,347	233,775	504,801	348,498
S. C.	52,126	72,756	48,243	81,644	123,133	89,735
Ga.	63,104	107,101	67,461	100,028	140,073	125,481
Fla.	42,704	64,436	63,584	72,494	80,880	88,421
Ala.	61,711	97,669	53,047	106,283	126,475	86,393
Southeast	219,645	341,962	232,335	360,449	470,561	390,030
Miss.	84,961	46,395	23,807	157,031	95,874	48,540
Ark.	38,700	35,500	23,550	66,416	76,873	48,025
La.	30,155	25,261	12,084	40,634	30,562	14,101
Miss. Delta	153,816	107,156	59,441	264,081	203,309	110,666
Texas	28,643	78,877	11,844	64,667	122,281	19,337
Okla.	5,000	30,000	3,000	29,823	68,298	7,060
So. Plains	33,643	108,877	14,844	94,490	190,579	26,397
N. Dak.	884	6,037	40	4,179	17,575	150
S. Dak.	501	1,347	40	7,134	10,768	0
Nebr.	12,450	1,495	0	67,960	16,580	0
Kans.	16,861	34,464	3,195	50,396	55,070	5,925
No. Plains	30,696	43,343	3,275	129,669	99,993	6,075
Mont.	1,943	4,370	45	4,676	9,930	90
Idaho	9,006	20,760	555	14,950	26,276	555
Wyo.	386	1,752	0	2,320	3,839	0
Colo.	2,432	6,350	0	6,116	10,271	0
N. Mex.	2,208	4,048	40	7,490	8,663	40
Ariz.	18,068	8,779	2,185	27,245	13,115	2,185
Utah	2,286	2,453	0	4,893	4,339	0
Nevada	131	550	0	876	2,476	0
Mountain	36,460	49,062	2,825	68,566	78,909	2,870
Wash.	8,839	9,743	3,443	23,328	12,733	3,988
Oregon	15,783	10,594	2,557	27,018	15,556	4,659
Calif.	125,653	59,867	12,216	171,985	101,509	13,379
Pacific	150,275	80,204	18,216	222,331	129,798	22,026
United States	1,026,004	2,088,391	1,081,876	1,977,291	3,220,831	1,916,142

1/ Includes 137,100 tons of P_2O_5 in the form of rock phosphate.
2/ Includes 211,000 tons of P_2O_5 in the form of rock phosphate.

SOUTHEASTERN WINTER GRAZING TOUR

The sixth annual Southeastern winter grazing tour attracted more than 200 persons who made part or all of the tour into South Central Georgia, North Florida and South Central Florida. It was coordinated by Borden S. Chronister, Chief Agronomist of the Barrett Division, chairman of the NFA pasture committee. It was conducted in Georgia by extension agronomists John Preston and E. D. Alexander, and in Florida by extension agronomist J. R. Henderson.

These on the tour represented fertilizer manufacturers, material suppliers, experiment stations, Soil Conservation Service, various extension services, the USDA, TFA, colleges of agriculture and outstanding farmers. The farm press was well represented. Those in attendance included citizens of all of the Southeast, plus some from Missouri, Washington, D. C., Illinois and Pennsylvania.

The tour covered four days, starting at Tifton, Georgia and winding up at Bartow, Florida where the group visited the phosphate mines of International Minerals and Chemical Corporation, and the Florida Range Cattle Station at Ona, where a large group of Tampa fertilizer men joined the party.

At the Gainesville, Florida, stop, NFA was host at a banquet presided over by Russell Coleman.

NEW ENGLAND CONFERENCE ATTRACTS 130

Despite rough winter weather, 130 turned out February 18 and 19 at Amherst, to attend the New England Fertilizer Conference. A distinguished group presented discussions of various aspects of the fertilizer situation.

The group was welcomed by Dale Sieling, head of the Massachusetts College of Agriculture. Noting that the population grows by 7000 each day, and that each extra mouth to be fed means more food, he reasoned that more fertilizer would be required to take care of this huge population gain.

W. G. Colby, head of the agronomy department followed with a talk on getting the most out of plant foods through good agronomic practices. And Joe E. Steckel explained the importance of lime on New England soils, and how lime and fertilizer work as a team.

The banquet that night was featured by slides taken in Mediterranean countries by Professor Ford Prince. They emphasized what happens to the land when bad practices and neglect of plant food needs are permitted.

The next day NFA President, Russell Coleman reviewed the fertilizer outlook, and the economies, in terms of capital and labor, when the yield per acre is figured against these costs.

A discussion on making fertilizers do their best featured Murry McJunkin, Coke Oven Ammonia Research Bureau; Joe Chucka, Eastern State Farmers Exchange; S. D. Gray, American Potash Institute; Mack Drake; William A. Albrecht, U. of Missouri. F. J. Sievers presided at all meetings.

Mostly Personal

Kenneth C. Towe, a director of **American Cyanamid** has been elevated to the presidency to succeed the late **Raymond C. Gaugler** who served only one year in that office.

* * *

Joe Herdin president of **Arkansas Farm Bureau Federation** has become president also of **Arkansas Farmers Plant Food Co.** to satisfy the demand by Federation members that they have a voice in the management of the Plant Food Company. He succeeds Ralph Hudson who resigned, but continues to fully support the operation.

* * *

William Drake, sales v-p of **Pennsalt** has joined OPS as director of rubber, chemicals and drugs division, succeeding **T. H. McCormack,** who returns to Grasselli division of duPont.

* * *

William B. Porterfield, Jr.'s appointment as assistant sales manager, U. S. Potash has caused the appointment of Sam E. Hardwick, Jr. to Mr. Porterfield's old territory, with headquarters in Richmond.

* * *

James C. Totman, manager of the Bangor, Maine, branch of **Summers Fertilizer,** was elected President of the City Council there, which makes him actually Mayor of Bangor, and the youngest mayor they have ever had. He has completed three years as a member of City Council, is a member of the State legislature, and has filed for re-election.

* * *

C. J. Watts, Jr. assistant manager of the **Naco** plant in Wilmington, N. C. is chairman of the new fertilizer safety section of the North Carolina Safety Conference.

* * *

Mary L. Alexander, assistant to the research director **Universal Oil,** Chicago, has been made chairman of the committee on nomenclature, American Chemical Society, division of organic chemistry, the first woman to head this committee.

* * *

Milton J. Weber has been named vice-president, procurement, for The Frank G. Hough Co., Libertyville, Illinois.

* * *

Eugene P. Alexander has been transferred to the Detroit sales office of **Chase Bag Co.** He will be succeeded in Cincinnati by **D. L. Herrick** of the Milwaukee branch.

* * *

Dr. E. G. McKibben, who has been in charge of USDA's Tillage Machinery Laboratory at Auburn, Alabama, has been made director of agricultural engineering research, bureau of plant industry, soils and agricultural engineering, Beltsville.

Frederick B. Grosselfinger, who has been appointed technical director by the Synthetic Nitrogen Products Corporation, New York, producers of "Cal-Nitro" and importers of potash. He will work closely with executive v-p Miguel Tegtmeyer and Dr. Werner Duehrssen. For his work in Italy, Dr. Grosselfinger was knighted by King Umberto.

Ray King's picture was in our February issue, along with other dignitaries who attended the Georgia Plant Food Educational Society meeting in Athens, Georgia. We called him "chairman of NFA" instead of past chairman. **J. E. Totman** will complete two years as chairman this June. Sorry. We knew better; a typographical error.

Frederic Arden, and **Leroy Stewart** of **NPA** resigned February 15. Mr. Arden, who has been assistant director of the chemical division will return to the **Mathieson Chemical Corp.,** Baltimore. He has been with NPA for a year.

Mr. Stewart, who has been chief of the facilities branch, will return to the Dow Chemical Co., Midland, Michigan.

ARKANSAS

Temple Cotton Oil, North Little Rock and Hope, have abandoned production of cottonseed oil and will concentrate on a line of fertilizers and allied farm chemicals. President **Latane Temple** said that most year-round personnel will be absorbed into the fertilizer unit, which will be operated only at North Little Rock. A $400,000 plant is projected.

* * *

Arkansas Plant Food Company, Little Rock, has peacefully solved the problem of protests from the **Farm Bureau Federation** which "contributed largely to the job of building the plant and yet had no voice in its operation." **Joe Hardin,** Federation president replaces **Ralph Hudson,** head of the **Arkansas Farmers Association** as president of the plant food concern. The Association has sole marketing rights. Mr. Hudson, who joined with Mr. Hardin in conducting the semi-annual meeting, pledged full support to the Plant Company board.

CALIFORNIA

Naco Fertilizer is conducting a mail order sales test on a new high analysis, water soluble plant food called **Nurish.** The test is backed by extensive advertising through a local nursery, and is aimed at the big home garden market of Southern California. **Batelle Institute** collaborated with Naco in the development of Nurish, a 20-20-20 analysis with minor plant foods added, which is marketed in moisture-proof packages.

* * *

Monsanto and **Tide Water Oil** are associated in a 250-ton sulfuric plant at Avon, using waste sludge and hydrogen sulfide from the Tide Water refinery, conversion to water-white acid by the Monsanto-Ross-Wilde process.

* * *

Agriform Company, El Centro, has a creed, which was sent us by **R. L. Luckhardt,** manager of their agricultural advisory service. "You can't kid a crop" it says. "Fertilizer is essential to agricultural production in our area." There's more, but that's the essence of a preachment which could well circulate through the entire industry.

Mr. Luckhardt says they are giving their customers two tests to prove the need for plant food—tissue tests from Purdue and U of Illinois, and check plots. They make permanent Kodachrome records of test results.

FLORIDA

Naco Fertilizer has told us of their plans to build a $650,000 unit to replace the fertilizer mixing plant destroyed by fire at Fort Pierce on November 3, so shortly after the destroyed plant had been built. President **Kenneth D. Morrison** says the new plant, to be built by **A. J. Sackett & Sons, Co.** Baltimore, will be of concrete, steel and asbestos structure, of 75,000 tons annual capacity, "unquestionably the most modern in North America."

A feature will be a specially-constructed mezzanine floor with a storage capacity for 1200 tons of bagged raw material. Twenty-nine bins, each with a 300-ton capacity, will provide storage space for bulk materials.

Machinery will include four "push-button" hopper systems, all controlled by compressed air. One hopper will be used for basing only, leaving three for blending operations. Each hopper contains eight compartments, assuring the continuous operation which is so important in maintaining the high quality of complex, highly-flexible Florida formulations.

A basing and shipping operation which will allow for the unloading of four materials at one time has been designed. The shipping dock will provide storage space for 500 tons of mixed fertilizer ready for shipment and faciiities for all-weather loading and unloading of materials and fertilizer.

The plant will be equipped with a four-ton mixer, which discharges into an automatic weigh hopper or on to a bulk conveyor for the loading of fertilizer for bulk-spreading on pastures.

U of Florida soils professors, Dr. **Luther C. Hammond** and **S. N. Edson,** have come up with a device to provide Florida farmers a quick, inexpensive and easy way to determine moisture content of soil for irrigation control. The device is based on the difference in specific gravity between water and mineral soils, and consists simply of a 2-liter cylinder, a calibrated spring scale and a stand to hold them. The scale is color-coded, so that no experience is required for operation. A patent is being applied for, after which the device will be put on the market.

* * *

Flagler Hydroponics, Miami, have developed an injector which goes between a water pump and its source, and mixes liquid fertilizer with the water, under valve and gauge control. It has been tested at the Orange Bowl. A patent has been applied for, and the device will be marketed for use in large area watering.

ILLINOIS

Buhner Fertilizer Company, Danville, celebrated the opening of their new plant by inviting the annual meeting of the Illinois and Indiana dealers. The plant is a $500,000 operation, with a 100,000 ton annual capacity—60,000 tons of mixed fertilizer; 40,000 of superphosphate. It is situated on an 8-acre site, covers some 50,000 square feet of floor space. Founded in 1880 by **Ferdinand F. Buhner,** now board chairman, the company is headed by his son, **E. J.** as president, with **C. R. Sparks** as general manager.

* * *

E&S Fertilizer & Supply Co. has been chartered at Decatur, by **Charles L. Edgecombe, Samuel D. Edgecombe, Sr.,** and **Arthur J. Edgecombe,** with 400 shares of $1000 common. They will deal in commercial fertilizer and do contract spreading.

LOUISIANA

Freeport Sulphur has begun work at Garden Island Bay and at Bay Ste Elaine, on sulphur mining operations in the swamps there. It will be an amphibious operation, though

Around the Map

part of the equipment will be erected on piles driven 90 feet down to solid sand through soupy muck. Molten sulphur from the wells will be turned into heated barges like floating vacuum bottles and shipped to Port Sulphur.

* * *

Jefferson Lake Sulphur has a contract giving them sulphur rights to Shell's dome at Black Bayou, Cameron Parish. Exploration shafts have been drilled. Frasch process will be used.

MASSACHUSETTS

Lee Lime Corp., West Stockbridge, and **J. S. Lane & Son,** Westfield, have joined in the operation of the West Stockbridge lime quarries. Lee Lime, of which **John M. Deely** is president, will distribute agricultural lime. The Lane concern will sell crushed limestone for road construction.

NEW YORK

National Gypsum, Buffalo, has been awarded a certificate of management excellence by the American Institute of Management.

NEW MEXICO

Duval Sulphur and Potash Co., as we went to press, were expecting their New Mexico potash plant to be in full operation. The equipment has all been tested. Capacity is expected to be 2000 daily tons.

NORTH CAROLINA

Robertson Chemical, Statesville, have begun shipments from the 400 daily ton plant recently completed.

OKLAHOMA

Oklahoma Fertilizer Co., will immediately build at Oklahoma City a $235,000 fertilizer plant with a 20,000 ton annual capacity. **Lester E. Cox,** president of Modern Tractor & Supply Co. made the announcement. **Dr. C. C. Crawford** president of **Sunset Fertilizer,** Bartlesville, is executive v-p and general manager. **J. M. Griffin** of Modern Tractor is secretary-treasurer.

* * *

Consumers Cooperative of Kansas is reported to be checking into the possibilities of the former Oklahoma Ordnance Works, checking especially the nitric acid section.

OREGON

Fortified Farm Products Co., Portland, is marketing a product called Nitro-Mulch, containing fertilizer, vermiculite and compressed peat moss. The fertilizer is a 3-6-6.

TENNESSEE

The Tennessee Farmers Co-operative will build a fertilizer plant about eight miles from Knoxville and will have the plant functioning sometime this spring. According to officials the product to be made would be mostly high-analysis fertilizers, approximately 30,000 tons annually.

* * *

Knoxville Fertilizer, Knoxville, is modernizing at a cost of approximately $250,000. Most of the company's thirty-year-old machinery is being replaced by modern equipment. A new continuous, automatic mixing mill will increase production by approximately 50 per cent. Phosphate rock is unloaded from hopper-bottom cars and transported by auger to the elevators.

Modern basing equipment with hoppers has been installed, also two valve-packing machines which increase packaging output by 25 per cent. It is estimated that the manpower to be saved by the complete modernization of the plant will range from 25 per cent to 40 per cent, depending on the operations concerned.

The acidulation unit of the plant has been remodeled and the entire plant is being overhauled.

The Knoxville Fertilizer Company was organized in 1921. In 1937 the company built a second plant in Nashville, Tenn., and in 1947 the firm put into operation a plant in London, Kentucky. These three plants serve Kentucky, Tennessee, Virginia and North Carolina.

Officers of the Knoxville Fertilizer Company are: **J. W. Dean,** president, **J. C. Dean,** vice president, **N. C. Meyer,** vice president, and **A. Carter Meyer,** treasurer, **Bennett Brown** Secretary.

Two of the company's best-known brand names are Dean's Choice and Bright Burley Brand fertilizers.

TEXAS

Jacksonville Fertilizer Company, Jacksonville, has changed hands. A minority stockholder, **W. S. Tyler,** has purchased the interest of **Henry Taylor,** and has become president and general manager. **James Ward** is assistant manager. The concern makes "Chief Brand" fertilizers.

* * *

Phillips Chemical has arranged a standby credit of fifty million dollars for plant expansion near Houston, to include sulphur, carbon black ammonia - methanol - petrochemical production.

* * *

Gulf Oil will build at Port Arthur a 300 daily ton sulphuric acid plant, to be constructed by **Leonard Construction.**

* * *

Hereford Fertilizer and Insecticide, Inc., Hereford, has been granted a charter, with $5000 paid stock. Incorporators are **Joe Ballinger, Norman E. Moore** and **Catherine W. Moore.**

Soil Biotics, Inc., San Antonio, has developed a bacterial culture process which in 30 days converts cotton gin waste into a humus of approximately the same composition as manure. Any ginner can apply the process, which requires only a pit and the special bacterial culture which Soil Biotics, Inc. sells.

AUSTRALIA

Norseman Gold Mines is planning an outlay of 350,000 pounds in Western Australia to develop pyrites resources in view of the sulphur situation. 150,000 pounds of this will be absorbed by the sinking of a new main shaft which will require 18 months. Meanwhile open cut methods will supplement present supply.

EAST GERMANY

Chemiewerk Oranienburg is now producing sulphuric acid from magnesium sulfate, with technical magnesia as a by-product. The government owned **ALCID** plant at Radebeul developed the process, as of great importance to East Germany because of the high quantity of magnesium sulfate resulting from potash production in that area.

OBITUARY

George D. Chamberlain, 53, vice president and secretary of The Gulf Fertilizer Company, Tampa, Florida, February 27. He was very active in civic affairs in his adopted city, was a past governor of the Advertising Federation of America, and a member of the board of school trustees of Hillsborough County.

Agronomy

(Continued from page 19)

half the acreage that was planted 20 years ago. This means higher production per hour or day of work. Quality has kept pace with increased production. For this we can thank our soil chemists for developing better fertilizers and for finding more efficient methods of using these fertilizers. The plant breeder has developed higher yielding varieties with higher quality lint and more disease resistance. Just try to imagine the situation cotton farmers would be in if the plant breeders had not developed varities of wilt resistance cotton. At present the cotton breeder is developing still better varieties with stronger lint and adapted to special uses. Progress in cotton production has not been due entirely to the efforts of agronomists. Better methods of controling insects have been developed by entomologists; pathologists have developed methods of treating seed which reduce damage from seedling disease; and the agricultural engineer has gone a long way toward mechanizing the production of cotton. Other branches of agricultural science, as well as industry, have contributed to the advance made in cotton production.

From the standpoint of acreage, corn is by far the most important crop in the South. The per acre yield has been notoriously low. During the past 10 years, the average yield of corn has increased by approximately 50 per cent. This increase has been due to the plant breeder producing hybrids adapted to southern conditions, to better cultural practices such as thicker spacing and heavier fertilization, particularly with nitrogen. The plant breeder and agronomist are still working and making progress in increasing still further the yield and quality of this important crop. The development of southern hybrids has not only contributed to the increased yield of corn in the South but it has also created a new source of income for the small group of farmers who are growing seed of hybrid corn.

Research has shown that new varieties and improved cultural practices can increase the yield of peanuts as much as 50 per cent. New varieties are more productive and are more resistant to concealed and visible damage. The breeder is making progress in developing better varieties and varieties adapted for special uses. The Soil chemist and the plant physiologist, with the use of radioactive materials, are learning more and more concerning the nutritional requirements of the peanut plant. Much progress has been made in the mechanical production and harvesting of peanuts. All of this means more economical production and a higher return per hour of work.

SOUTHERN AGRICULTURAL WORKERS MEET

P. O. Davis, AES, Auburn, Ala. retiring president of the Association of Southern Agricultural Workers; C. N. Shepardson, Texas A&M, new president; B. B. Jones, the perennial ASAW secretary treasurer, Extension Service, Louisiana. The convention, held in Atlanta February 4-6, attracted more than 1200. It was immediately followed by the Southern Weed Conference, which ran through February 8. Both conventions were packed with noted speakers, presenting technical papers of excellence. Both were well-attended and thoroughly constructive.

Tobacco is a major crop in certain sections of the South. This crop has benefited from the results of research. Higher producing varieties with better quality and with more disease resistance have been developed by the plant breeder. The control of disease, especially in the seedbed, by the use of chemicals has effected a great saving to the tobacco farmer.

Oats and wheat are the major small grains grown in the South. These crops fit naturally in many crop rotation systems. They give better distribution of labor and machinery, furnish winter grazing, produce a grain crop, and protect the soil during winter months when protection is so badly needed. Many new and improved varieties have been developed recently. However, because of the advent of new diseases, better varieties will need to be produced before small grains occupy the place in our farming system that they deserve.

Only a short time ago soybeans were considered primarily a corn belt crop. More recently soybeans have become a leading crop in parts of the South. With the improvement of cultural practices and the development of new varieties, some of which are just ready for release, this crop should continue to increase in importance.

Yield and quality of other crops, such as grain sorghum, sweet sorghum, sugarcane and rice have been increased as a result of agronomic and related research. The practice of rotating rice with improved pastures has resulted in increased yields of rice as well as an increase in livestock and livestock products.

The pastures and livestock program of the South has recently received more publicity than any other phase of agriculture. Compared to crops such as cotton, research in the field of pasture and forage crops is relatively new. The improvement of forage crops by breeding is just getting under way on a sizeable scale. Only a few improved strains have just been introduced to date, however, these few indicate the progress that might be expected in the future. With the proper use of fertilizers and choice of the right forage plant food pastures are now being grown on land that only a few years ago was classed as waste land. This has resulted in an increase in the farmers' income from land that had been producing little or no income. The percentage of the farmer's total income now coming from livestock products is more than double what it was 20 years ago. As the acreage established to grass-legume mixtures and to deep rooted perennials increases, soil fertility will increase and yields of other crops will in turn be increased.

With the introduction of improved strains of field and forage crops some mechanism was necessary for increasing seed of these crops and at the same time maintaining their genetic purity. The result was an increase in the activity and the establishment of crop improvement associations throughout the South. This has provided a new source of income for those farmers who are interested in seed production.

Many other accomplishments could be cited, however, the main purpose of this paper is not to merely survey agronomic progress made in southern agriculture. The main purpose of the paper is to attempt to emphasize the necessity of cooperation, not only between the different branches of agronomy, but cooperation between all branches of agricultural science and cooperation with industry. Through cooperation we have made progress in the past. Progress in the future will be determined largely by the extent of cooperation between agencies and between individuals.

Another four-wheel drive payloader has been made available by The Frank G. Hough Co., 702 Seventh Street, Libertyville, Illinois. It has one cubic yard bucket and is powered optionally either with a 60 h.p. diesel or a 54 h.p. gasoline engine. It is similar to the $1^1/_2$ yard model HM that has been so well received. Powerful automatic digging action is independent of the forward motion, and automatic quick tip back of the bucket permits heaped loads to be carried low for good balance and operator visibility. Attachments are available. Write the manufacturer for full information.

Clemson Conference Scheduled for May 21-22

All fertilizer manufacturers, dealers and salesmen operating in South Carolina are invited to attend the annual South Carolina Fertilizer Conference to be held at Clemson College, May 21-22. Dr. B. D. Cloaninger, suggests that reservations be made at the Clemson House, the new hotel adjacent to the University grounds, and reports that an excellent program has been assembled.

NFA Committee Reports On Insecticides in Fertilizers

The NFA subcommittee on chemical weed and insect control has issued a report on State laws concerning the incorporation of insecticides in fertilizers. The committee consists of M. V. Bailey, chairman; T. F. Bridgers, M. F. Gribbins and F. H. Leavitt.

NFA Issues New Publication

A new publication known as "Fertilizer Process Progress" is being issued by NFA. It reports current developments in fertilizer manufacture.

In the Field of
ALLIED FARM CHEMICALS

NAC ANNOUNCES PROGRAM FOR SPRING MEETING

L. S. Hitchner, executive secretary of the National Agricultural Chemicals Association, slated for the Fairmont Hotel, San Francisco, April 6-9, has announced the program:

A reception for members will be held Sunday, April 6. The opening meeting begins Monday morning with a report by association president Arthur W. Mohr, President of California Spray-Chemical Corp. The group will then hear addresses by W. E. Ball, President of the Western Agricultural Chemicals Association, Joseph E. Cary, Exec. Vice-Pres. of the Food, Machinery & Chemical Corp.; W. R. Allstetter, Deputy Director of the Office of Materials & Facilities, PMA, USDA; and Dr. G. F. McLeod, Technical Vice-Pres. of Sunland Industries, Inc., Fresno, Calif. No business sessions are scheduled for Monday afternoon.

The Tuesday morning session will consist of a business forum and presentation of problems by members of the NAC staff and committees. The golf tournament will take place in the afternoon and the annual banquet is scheduled for the evening.

Wednesday morning members of the Association will hear addresses by Dr. Stanley B. Freeborn, Univ. of California, Berkeley; W. C. Jacobsen, Ass't. Director, California State Dept. of Agriculture; and Dr. A. M. Boyce, Head, Div. of Entomology, California Citrus Experiment Station, Riverside.

Entertainment for wives and families of members include bus and steamer tours, a luncheon and fashion show.

35 Years in Entomology

By C. H. ALDEN, *Chairman*

Cotton States Branch, Amer. Assn. Economic Entomologists.

When I started out in Entomology in 1915, things were tough. We were in the middle of a mild depression and jobs of all kinds were scarce and nobody seemed to want any entomologists. I remember that 32 of us, including some Ph.D.'s took civil service exams and one Ph.D. got a regular job and I got a part-time job for the summer. It did not look then as if there was much opportunity in the field of entomology and that it was already overcrowded.

Let us look back on conditions as they existed in 1915. The Bureau of Entomology had about 200 men on the staff and their headquarters was in a small brick building near the main Agricultural Building (both since torn down). The Plant Quarantine Act of 1912 was just beginning to function. The average starting salary of an entomologist was about $100.00 per month. Some states did not even employ an entomologist. Paris green was the main insecticide, although lead arsenate was beginning to supplant it. The Gypsy moth was about the only insect under quarantine. The Japanese beetle, the Oriental Fruit moth were found in 1916. Quarantine programs were comparatively simple or grossly ineffective. If you had the cooperation of railroads and the post office, contraband material could be kept out of trade channels. Control methods and equipment were comparatively simple. The general public, if they knew anything about an entomologist, looked upon him somewhat as a freak running around the country with a net, trying to catch a butterfly. One class of people, the farmers, were beginning to realize the value of the entomologist, as some of them had had sad experiences with the bugs eating up their crops. The boll-weevil was spreading rapidly and no good controls were available. Lime sulphur was the dormant spray material in general use. State and Federal appropriations were either nil or meager. The Journal of Economic Entomology had been published for about seven years, but the membership of the Association was still very small. The Federal Government had civil service, but only a few states had adopted it. There was no pension or retirement system. Advancement was very slow and some entomologists had worked for the same salary for years and years. Of course, there were some good points, too. Most of the entomologists knew one another personally; the work was steady and interesting if you could get a regular job; a dollar would buy a lot of stuff; and there were no income taxes, withholding taxes, social security taxes, retirement taxes, or insurance taxes to pay. You did not have to drive an automobile over dangerous highways, in fact, my first transportation furnished by the Federal Government was a bicycle, later I had the use of the back seat of a motorcycle and I hate one of those things to this day.

I could go on and on, but let us see what has happened over the next 35 years, which is the normal working period in the life of an entomologist. Quarantines have been enlarged and improved and many of them have become uniform for both intra and inter-state shipment. Measures for enforcing them have been developed and where they are effective they have a permanent staff attached for enforcement.

There are still lots of problems, though, especially when faced with this high speed truck and airplane transportation. While we thought a barrel pump was the last word in 1915, we now have high pressure spray tanks, jeep and turbine blow-

ers, power off-takes, airplane sprayers and dusters and a host of other devices for insect control. Along with it have been developed a tremendous number of insecticides and fungicides and the new synthetic organics are just beginning to come into their own. Most entomologists are now working under civil service and retirement regulations and there are many jobs available in private industry. The number of entomologists has swelled from about 300 to 5000, and we thought the field was crowded in 1915.

I feel that the world is making progress. Certainly science is making progress and I know none of us would want to return to the conditions that existed in entomology in 1915. We need to do two things; expand our activities so that every State in the country will have one or more entomologists; and improve our public relations, so that the needs for entomological work will be better known by the public. That will be real progress.

Albert Fuchs, with them since 1944, has been made manager of the insecticide division of the **Naco Fertilizer** plant at Charleston, South Carolina.

* * *

L. J. Polite, Jr. long active in the sales of chlorinated solvents for **Diamond Alkali,** has been transferred to their organic chemicals division, attached to the sales staff of **Kolker Chemical,** Diamond subsidiary specializing in organic chemicals for agriculture.

* * *

Delta Insecticide and Chemical Co., North Little Rock, Arkansas, affiliate of **Stauffer Chemical,** is expected to complete its $100,000 plant by the middle of this month. **Homer N. Adkins,** former Governor of Arkansas is president.

Stauffer Chemical is reported to have optioned 450 acres at Fredericksburg, Virginia, but has made no announcement of its plans except that it is part of the long range program to set up eight plants from coast to coast.

* * *

U of California Citrus Experiment Station reports that the life of lemons can be prolonged when the stem end of the lemon is kept alive and green by the use of the weed hormones 2,4-D and 2,4,5,-T. Storage life is greatly increased because internal changes are delayed.

* * *

The Insecticide IAC was told by NPA that, with the exception of pyrethrum, most of the ingredients used in making insecticides are in good supply. The committee urged the release of some of the stockpiled pyrethrum for use by the industry.

Photos made at the first meeting of the Fertilizer Section, Southern Safety Conference, Atlanta, Ga., March 3, attended by some 80 fertilizer executives. At left, reading top to bottom: 1. John E. Smith, vice-chairman, Fertilizer Section, National Safety Council, (Spencer Chemical Co.), Jack Fields, Chairman, (Phillips Chemical Co.), V. S. Gornto, Secretary-Treasurer, and Chairman of the Fertilizer Section's program at the Southern meeting, T. J. Clarke, Editor, Fertilizer Safety News. 2. Program speakers: R. E. Eeitz, Safety Engineer, Glenn Falls Indemnity Co., Richmond, Va., C. E. Killebrew, Sales Manager, The Frank G. Hough Co., Libertyville, Ill., H. R. Krueger, Director, Technical Service, Phillips Chemical Co., Bartlesville, Okla., W. N. Watmough, Jr., Vice-President, Mixed Fertilizer Division, The Davison Chemical Corp., Baltimore, V. S. Gornto, Smith-Douglass Co., Inc., Norfolk, U. C. Ellis, General Supt., Plant Food Division, Swift & Co., Chicago, J. M. Sisson, Safety Officer, TVA, Wilson Dam, Ala. 3. Paul Truitt, President, APFC, and Russell Coleman, President, NFA. At right, top, C. J. Watts, Jr., Chairman of North Carolina Section (Naco Fertilizer Co., Wilmington, N. C.), and W. C. Richardson, Chairman of Virginia Section (Southern States Coop., Richmond).

MORE THAN 300 ATTEND MIDWEST MEETING

Soils research men from 13 Midwestern agricultural colleges and representatives of the fertilizer industry and allied businesses held their annual meeting at the Palmer House in Chicago, Friday, February 22. More than 300 persons attended.

Presiding at the meeting was Dr. Garth Volk, head of Agronomy, Ohio State University. The soils men were welcomed by J. D. Stewart, Louisville, president, and Z. H. Beers, Chicago, executive secretary of the Middle West Soil Improvement Committee, sponsors of the meeting.

Fertilizer supplies will continue "tight" for the 1951-52 season, reported John R. Taylor, American Plant Food Council, who said indications are that record breaking total quantities of fertilizers will be produced for the 14th consecutive year. With farmers calling for more fertilizers and a shortage of certain materials, all farmers in all areas may not get exactly what they want this year.

Dr. William A. Albrecht, soils department head at the University of Missouri declared that the phenomenal growth in fertilizer use in recent years has resulted from increasing farmer recognition of declining soil fertility and the need for soil treatments to build up the soil rather than merely to stimulate crop growth. Prof. Arnold W. Klemme, Missouri extension agronomist, reported that plowing down full fertilizer treatments according to soil tests gave forage for milk yields ranging from 1.9 to 5 tons per acre on reseeded permanent pastures, compared to less than one ton on untreated pasture. G. E. Smith, University of Missouri soil man, said that corn yields as high as 134 bushels per acre had resulted from fertilizer use following red clover on test plots, compared to a low of 8.6 bushels on a continuous corn plot without fertilizer treatment. The influence of soil type on yields is pretty well lost, said Smith, when full fertilizer treatments are added according to soil test.

The one great remaining opportunity for low cost feed production for meat and milk lies in the improvement of permanent pastures, declared Prof. C. J. Chapman, extension soils specialist at the Uni-

versity of Wisconsin. Dr. F. W. Smith, Kansas State College, described the fertilization tests on corn, wheat, and oats, and the response to nitrogen, phosphate, and potash fertilizers.

Dr. George Stanford, Iowa State College, reported on tests involving the fertilization of oat-legume seedings and on the meadow following, in which frequency of fertilizing, rate and method of application were important considerations. Dr. L. O. Fine, South Dakota State College, said that the largest increases in wheat and oats yields were obtained by a nitrogen-phosphate fertilizer.

Pointing out that the nitrogen content of Nebraska soils has been declining steadily, Prof. H. F. Rhoades, University of Nebraska, said that there will be an increasing need for the use of nitrogen and phosphate in that state. He estimated an annual consumption of 110,000 tons of nitrogen and 54,000 tons of phosphate with profit to the farmers.

Dr. W. P. Martin, Ohio State University, presented a film on Krillium and answered questions based on their experience with the new material. To achieve the ideal aggregation in the plow layer would take up to 2,000 pounds of the material per acre, he pointed out, but that there could be many uses short of this ideal situation.

Dr. R. L. Cook, Michigan State College, described a research project which is designed to give detailed information on the establishment, maintenance and persistence of legume-grass seedings as related to fertilizer and other management practices.

S. A. Barber, Purdue University, reported that the rate of build up in the soil depended upon the soil type and the previous existing level of fertility in the soil. Maximum crop production according to the soil tests used in Indiana would call for 150 pounds of available P_2O_5 and 250 pounds of available K_2O per acre.

Increases of as much as 67 bushels of corn per acre have resulted from adding a mixed fertilizer high in potash in tests at experiment farms in Illinois P. E. Johnson reported. On fields low in potash, he said, yield increases were in direct relation to the potash content of the fertilizers, and a direct correlation between the incidence of helminthosphorium in the corn and the potash in the fertilizer.

Dr. Harold E. Myers, Kansas State College was elected chairman of the meeting for the coming year.

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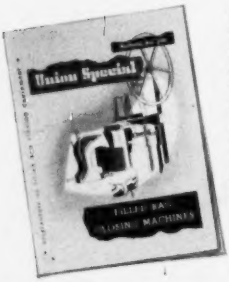

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